w-Hill Publishing Company, Inc. NOVEMBER, 1928 Thirty-five Cents Per Copy

CHEMICAL
& METALLURGICAL
ENGINEERING

the Production Man in the Chemical Engineering or Process Industries interested in heavy, fine, and electro-chemicals, cement, lime, ceramics, lose, coal products, explosives, fertilizers, glass, leather, paint, varnish, oils, pulp, paper, petroleum, rubber, soap, sugar and similar products.

CHEMICAL & METALLURGICAL ENGINEERING

VOLUME THIRTY-FIVE - NUMBER ELEVEN

NOVEMBER, 1928

S. D. KIRKPATRICK, *Editor*

HENRY M. BATTERS
Market Editor

THEODORE R. OLIVE

R. S. MCBRIDE
Washington

PAUL D. V. MANNING
San Francisco
Assistant Editors

M. A. WILLIAMSON
Publishing Director

McGRAW-HILL PUBLISHING COMPANY, INC.,
Tenth Avenue at 36th Street
NEW YORK, N. Y.
Cable Address "Machinist, N. Y."

JAMES H. MCGRAW, Chairman of the Board
MALCOLM MUIR, President
JAMES H. MCGRAW, JR., V.-Pres. and Treas.
EDWARD J. MEHREN, Vice-President
MASON BRITTON, Vice-President
EDGAR KOBAK, Vice-President
HAROLD W. MCGRAW, Vice-President
C. H. THOMPSON, Secretary

NEW YORK, Dist. Office, 285 Madison Av.
WASHINGTON, National Press Building
CHICAGO, 7 South Dearborn Street
PHILADELPHIA, 1600 Arch Street
CLEVELAND, Guardian Building
ST. LOUIS, Bell Telephone Building
SAN FRANCISCO, 883 Mission Street
LONDON, 6 Bouverie St., London, E.C.4

Publishers of
Food Industries
Electrical World
American Machinist
Electrical Merchandising
Engineering and Mining Journal
Chemical and Metallurgical Engineering
Bus Transportation Power
Coal Age Radio Retailing
Electric Railway Journal
Engineering News-Record
Ingeniería Internacional
Construction Methods
Electrical West
(Published in San Francisco)
American Machinist—European Edition
(Published in London)

SUBSCRIPTION PRICES: United States and its Possessions, Canada, Mexico and other countries taking domestic postage rates, $3 a year. All other foreign countries, $5 a year. Single Copy, 35 cents. Published monthly. Entered as second class matter, July 13, 1918, at the Post Office, New York, N. Y., under the act of March 3, 1879. Printed in U. S. A.

CHANGE OF ADDRESS
Subscribers are requested to send both the old address and the new address when they move to a new address.
Member—Audit Bureau of Circulations.
Member—Associated Business Papers.

Number of Copies Printed This Issue, 12,400

McGraw-Hill Publishing Co., Inc.
James H. McGraw, *Chairman of the Board*
Malcolm Muir, *President*
H. C. Parmelee, *Editorial Director*

CHEMICAL & METALLURGICAL ENGINEERING

M. A. Williamson, *Publishing Director*

VOLUME THIRTY-FIVE - NUMBER ELEVEN

NOVEMBER, 1928

S. D. KIRKPATRICK, *Editor*

A New Name on the Masthead

WITH this issue of *Chem. & Met.* a new name appears on the masthead. H. C. Parmelee who has been editor of the magazine for the past ten years gives up this intimate relationship only to assume larger duties as editorial director of all the McGraw-Hill publications. This appointment is the culmination of eighteen years of editorial service, in the course of which Mr. Parmelee has contributed not only to the advancement of *Chem. & Met.*, but also to the education movement in business paper journalism and the development of sound editorial practice in the house of McGraw-Hill.

In naming S. D. Kirkpatrick as his successor the publishers recognize and repose confidence in his ability to promote the standards of excellence and the spirit of service that have characterized *Chem. & Met.* from the beginning. He has long shared as associate editor in the work of bringing the publication to its present position of prestige and influence in the field of chemical engineering.

During the twenty-six years of *Chem. & Met.'s* existence, Mr. Kirkpatrick is only the third to hold the important post of editor. Of his predecessors, Dr. E. F. Roeber was one of the founders of the publication and its first editor from 1902 until his death in 1917. Mr. Parmelee was then appointed editor, having been on the staff since 1910. Mr. Kirkpatrick joined the organization in 1921 and now becomes the third in line. Thus through overlapping periods of editorial direction *Chem. & Met.* has been given a continuity of policy that has been an important factor in perpetuating its high publishing standards.

The new appointments of Mr. Parmelee and Mr. Kirkpatrick are made in the firm belief that they will enable both *Chem. & Met.* and McGraw-Hill to enhance their service to engineering and industry.

James H. McGraw.

Mergers That Emphasize Industrial Interdependence

CURRENT trends toward mergers and consolidations are beginning to result in definite developments in the chemical engineering field. Several mergers have been announced and there is evidence that others are under consideration. In all that have been proposed or actually consummated, a factor which is likely to be overlooked is the fundamental inter-industry relationship that makes mergers, from a technical standpoint, more logical than the usual trade or industrial combination.

This trend in chemical industry finds its most advanced expression abroad, particularly in the dominating groups in Germany, England, and France. There has been a bringing together of individual companies or entire industries that are interdependent for important raw materials, for manufacturing processes and equipment and for technically trained personnel in production and sales. The larger of these foreign chemical combines have been of the vertical type, i.e., the association of units representing various stages of manufacture from raw material to finished product. But in addition, particularly through the cartel organization in Germany, there has been a spreading of the horizontal type in which competitive interests have been fused to bring control into the hands of a single unit. In America, at least in the past, our chemical mergers have been largely of the vertical or production type in contrast with the distribution type that now holds the center of the stage.

The du Pont-Grasselli consolidation, which was finally ratified by stockholders on November 10, the International and Mond Nickel merger which is on the way to completion, the Krupp-Ludlum Steel alloy arrangement, and the Colgate-Palmolive-Peet merger consummated some months ago—are all in the direction of lessened competition and broader opportunity for trade expansian. All of them involve, however, fundamental technical economies in production as well as market advantages. By the first, du Pont becomes a national factor in the heavy chemical industry where heretofore its distribution, except for a very few chemicals, had been geographically limited. The merging of the twenty-one Grasselli plants with their diversified output likewise offers an opportunity for profitable interchange of raw materials, and semi-manufactured and finished products. That the long established name brought to this country in 1839 by Eugene Ramiro Grasselli is to be continued is not only good business but a deserving recognition of a worthy pioneer.

The desirability of a close community of interest between the International Nickel and the Mond Nickel companies became apparent when Mr. Hayden and Lord Melchett disclosed their companies' plans for practically parallel development of their respective properties. By avoiding the unnecessary duplication in plant facilities, management and sales organization that would have been incurred if the two programs had been carried out separately, there should be a saving not only to the stockholders but to the users of nickel products. Likewise the Krupp-Ludlum merger, by pooling patents on a number of new and important alloys, has opened the way for economies in the American development of these products.

Other mergers affecting chemical industry might be similarly analyzed to show that, from the standpoint of industrial interdependence, they are technically sound in conception. Whether or not they are equally sound and logical in operation depends on whether they are used to serve or to exploit. The public looks to them for improved service and increased economies.

A New Type of Leadership

FOR the first time in history a technically trained man has been elected to the highest office in the land. To be sure, it was not Herbert Hoover, the engineer, but Herbert Hoover, the man, to whom a great majority of the American people entrusted the leadership of our national government. They have, however, keenly appraised his unique personal equipment and, without regard to sectional differences or party traditions, have delegated this great responsibility to him. Those who have been privileged to know him intimately and those who have merely observed his remarkable record in discharging other responsibilities are confident that under this new type of leadership the next four years will see a tremendous advance in American government.

Stevenson Act Is Consigned to Grave

NOVEMBER 1 saw the termination of an important chapter in the economic history of crude rubber. After an existence of six years, the Stevenson Act has ceased to operate. Its passing is convincing proof of the fallacy of any governmental attempt permanently to raise the level of world prices by an arbitrary limitation of trade volume.

Immediately after the Stevenson Act became effective there occurred an amazing and unexpected increase in rubber production in the Dutch East Indies. A great impetus was likewise given to the planting of rubber trees in various other parts of the world. A campaign on the part of the rubber manufacturers in the United States for the conservation of crude rubber led to the development of the reclaiming industry on a sound chemical engineering basis. With a general recognition of improved qualities in the reclaimed product, a larger proportion of it was substituted for crude rubber. The outcome, as far as the original purpose of the Stevenson Act is concerned, has been a considerable decrease in the amount of rubber coming from British possessions, dropping from 65 per cent of the world's supply in 1922 to 55 per cent in 1927. The end of this downward trend is not yet in sight.

Great Britain, once supreme in the rubber growing industry, has by the Stevenson Act so injured her trade that the wound will never heal. Instead of strengthening her position, she has permanently weakened it. The withdrawal of this act can only be interpreted as a frank admission of the futility of legislative amendment to economic law.

Where is the Gas Man Headed?

THERE has been a radical change of attitude in the city-gas industry within the last five years with respect to chemical engineering methods and technology. In the immediate post-war period the gas man used relatively little of the new machinery or new plant methods common to other chemical engineering industries. Today every development of this sort is quickly seized upon and keenly appreciated.

The change in attitude toward chemical engineering economics is no less striking. The recent meeting of the American Gas Association exhibited that industry in its technical division devoting a large part of its time to such questions as—What kind of raw materials should we use? What new materials and processes are available? What is the ideal gas plant? These questions and others were attacked with reasoning characteristic of the chemical engineering mind.

This modified policy has probably resulted in large measure from the fact that the association now holds annually a Production Conference and a Distribution Conference at which the details of technology can be considered. But whatever the cause, the result has been a much broader treatment and a much more comprehensive view of the industry at the annual meeting than was usual some years ago.

This is an exceedingly fortunate development. It augurs good things for the industry as a whole. *Chem. & Met.* congratulates the industry, not only upon the fact, but upon the recognition of the fact, as it was stated by one of the most prominent committee chairmen: "It is very gratifying to know that the statement made a year or so ago to the effect that 'the real competition in which the gas industry is involved is that between research and tradition' is becoming less and less true."

In this issue are reviewed some of the outstanding trends which figured in the discussion of the recent meeting. The peculiar importance of some of these economic problems has seemed to warrant a presentation of only a few of the subjects considered and a reference for those of our readers interested in further details to the printed proceedings of the association.

Phosphoric Acid in the Ascendency

THIS country, with its abundant resources of phosphate rock, has been inclined to underestimate the importance of the rôle of phosphoric acid in chemical and fertilizer technology. To be sure, we have a healthy and long-established superphosphate industry and there has been a promising growth in chemical phosphate manufacture, but these have only begun to tap our possible resources. The immediate future appears to hold a number of developments that will have an important effect upon their ultimate exploitation.

It may be said that we are in a transition period in this field. If we were to chart the development of phosphoric acid apart from the superphosphate industry, a curve showing the volume of output would start rather modestly shortly after the war when production was largely confined to the medicinal and very pure grades of the acid and its derivatives. Then, as the change was made toward cleansing compounds and other industrial products, the volume curve would rise—having as its ultimate goal the manufacture of phosphoric acid for concentrated fertilizers. On the same chart, a price curve would show exactly the reverse phenomenon. The necessarily high prices for the pure products would be reduced in the average as the industrial materials assumed greater volume and must eventually become of little significance when the industry reaches its final goal in fertilizer production. Just where we stand today on such an imaginary chart is a matter of conjecture, but its trends indicate the direction in which we are going.

The synthetic fertilizer industry abroad has begun to use phosphoric acid as a nitrogen carrier in various of its new concentrated products. In this country there has

been but little development in this direction but the fact that some of our superphosphate producers are beginning to reverse the process by using ammonia in their manufacturing operations is evidence that there is an appreciation of the necessity for eliminating inert and valueless ingredients. It is further to be expected that some of the newer phosphoric acid processes already in use abroad will soon find application in the United States.

Another of the developments that is being watched with interest is the blast-furnace plant for the production of phosphoric acid which is now under construction at Nashville, Tennessee, for the Victor Chemical Works. The remarkable growth in the production and use of trisodium phosphate, which is referred to in some detail on page 672 of this issue, was doubtless one of the factors that stimulated this new venture. If it proves successful, its output will add considerable to the present supply and will thus bring the industry that much nearer its ultimate goal.

These developments, with the continued growth and expansion of the typically American industries represented by the Federal Phosphorus Company in Alabama and the Anaconda Copper Mining Company in Montana, are some of the factors that have brought phosphoric acid to the center of the chemical stage in the United States. Succeeding acts in the performance will be watched with a great deal of interest for they are to have a bearing on a great American resource and two basic industries.

Agent Representation Invites Western Competition

ALL unwittingly the Eastern manufacturer of chemicals and chemical engineering equipment has aided in establishing his own competition on the Pacific Coast. Rapid industrial growth and development have demanded not only machinery and supplies but expert advice from the manufacturer. Western industry is becoming intolerant of the delay in supply and technical service occasioned by the agency plan of distribution and as a protest is encouraging local development.

Too many Eastern manufacturers have handled their Pacific Coast business in a manner akin to foreign trade. They have established a single agency or perhaps two at the most. Often times this has been done at the solicitation of some local sales agent interested only in a selling proposition. These men may and usually do handle several lines, some of which may be competitive in character. They are seldom able to supply technical information about the products they attempt to sell. Stocks are not available without waiting for factory shipments and engineering advice on repair or installation requires time-consuming correspondence with Eastern headquarters.

As a consequence many small Western plants have been established. At first these supplied only a very local demand with a quality product but today they are beginning to compete with the Eastern manufacturer in neutral territory and in a few instances even in the East. This competition may be expected to increase with the development of more chemical and equipment factories and the building of versatile engineering staffs on the Pacific Coast.

What is usually needed is a branch office with adequate warehouse stocks ready for immediate delivery. The man in charge should be a factory representative, preferably a sales engineer who knows the company's products —how they are made and how they are used. Only in this way can the Eastern manufacturer expect to build a business that will insure him a continuous profit.

Better Recognition in Governmental Service

PROGRESS of a type distinctly interesting to the chemical profession has recently been made at Edgewood Arsenal. The indefatigable chief of the Chemical Warfare Service has succeeded, after a sustained effort of more than three months, in securing official approval of an improved scale of salaries for the technical men in civilian employ of the service. With the revision of salaries there has also been a revision of responsibilities. A new scheme of organization has been set up at the arsenal to insure efficient operation—both as a research agency and as a production unit equipped, if necessary, for war-time operations.

As a result of the recent increases there appears to be a greater appreciation of the value of chemists and engineers in this branch of governmental service. Whereas in 1923 the highest paid technical man at Edgewood Arsenal was a chemist with a salary of $5,000, the Chemical Warfare Service now has the authority for employing a chief chemist at $8,000, two others at $6,000, four at $5,600, six at $4,600 and a correspondingly larger number at slightly lower salaries. When it is considered that a number of these men live on the post in governmental quarters, it is apparent that the net remuneration is comparable with, or actually more than, that paid for equivalent work in chemical industry. In spite of this, however, the Service loses from 20 to 40 per cent of its best men each year. This is not unusual in a governmental organization in which there are definite limits for financial advancement, but in this case it is not an unmixed evil for there is educational work to be done on the outside as well as actual work on the inside of the Chemical Warfare Service.

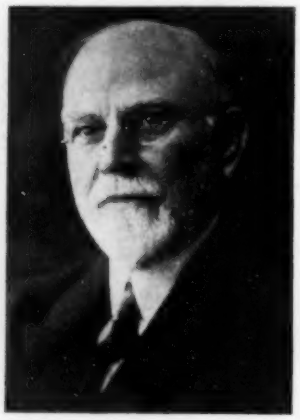
The new scheme of organization at Edgewood is based on the fact that there are two types of chemical work underway there. There is first, the type of research and development necessary to produce a finished product, such as a war gas or a new protective mask. The other type is fundamental research, which can seldom be translated immediately into direct production for the needs of either war or peace. Both fundamental and production research have a place in the new organization and at the head of each is a man on whom rests the final authority for results. In addition to research, there is to be a medical division, a munitions development department, a defense development division, an engineering division and an information division. All divisions report through the chief chemist to the technical director.

These changes appear to mark constructive steps in the development of the Chemical Warfare Service to a more efficient basis as a technical organization. Chemical industry and the chemical profession are intimately concerned with this progress because of the close relation between technical developments of war- and peace-time significance. As an essential arm of the national defense, the Chemical Warfare Service must not only keep abreast of chemical technology but must pioneer into highly specialized fields. To do this well requires the highest class of technical personnel working together in an efficient organization.

Growth in Opportunity and Obligation

As the growth and expansion of the McGraw-Hill Publishing Company has extended its influence into the whole field of American business, there has come the opportunity for broader service. Better to meet this opportunity and the obligation it carries with it, a new plan of organization has been effected in which *Chem. & Met.* is peculiarly and intimately concerned.


MALCOLM MUIR


JAMES H. MCGRAW


Bachrach, Inc.
S. D. KIRKPATRICK


Blank & Stoller
H. C. PARMELEE

On November 1, by action of the Board of Directors the offices of Chairman of the Board and President, both of which have hitherto been held by James H. McGraw, were separated, and Malcolm Muir was elected President and Chairman of the Executive Committee of the McGraw-Hill Publishing Company. Mr. McGraw, continuing as Chairman of the Board, becomes free to visualize the problems of American industry and to direct and interpret McGraw-Hill policies in their solution. Mr. Muir, as chief executive officer will continue to maintain the policies and high standards that have always characterized the McGraw-Hill Publishing Company.

Malcolm Muir, through long conection with *Chem. & Met.,* is well known to many of its readers. When he joined the advertising department of this magazine in 1905, it was *Electrochemical & Metallurgical Industry.* Five years later, when its name was changed to *Metallurgical & Chemical Engineering,* Malcolm Muir was its business manager. From this position he was promoted in 1917 to become general manager of a group including this magazine, *Engineering and Mining Journal* and *Coal Age.* During the past ten years, he has had, as vice-president of the McGraw-Hill Publishing Company, an important part in each step in the company's growth to its present position, comprising nine subsidiary and associated companies, publishing 24 engineering, business and industrial magazines, as well as scientific and business books, trade and professional catalogs, and directories. The company's study and advisory work on industrial marketing has also been under his direction. Mr. Muir has been a leader in the work of the Associated Business Papers, serving as its president in 1925-1926, and has been an important factor in raising the editorial and publishing standards of the business press.

Recent developments have greatly multiplied executive responsibilities, and have necessitated further readjustments in the administrative duties of the company's principal officers. As announced last month, Edward J. Mehren, vice-president and editorial director, has assumed the editorship of *The Magazine of Business,* which is published in Chicago. He goes there to become the resident vice-president of the McGraw-Hill Publishing Company. In his position as editorial director, he has now been succeeded by H. C. Parmelee, who as editor of *Chemical & Metallurgical Engineering* and *Food Industries* has also served as vice-chairman of the Editorial Board of the McGraw-Hill Publishing Company.

Since its founding in 1902, *Chem. & Met.,* has had but two editors, E. F. Roeber and H. C. Parmelee. The latter joined the staff on March 15, 1910, as western editor, and with headquarters in Denver, carried forward and extended the editorial influence of the publication. In the fall of 1917, following the untimely death of Dr. Roeber, Mr. Parmelee returned to the editorial staff, after having been absent for a year serving as president of the Colorado School of Mines. In October, 1918, he was appointed editor, and in the ten years since that time his editorial direction has been marked with the same courage and vision, accuracy and authority that was personified in the dominant spirit of its first editor.

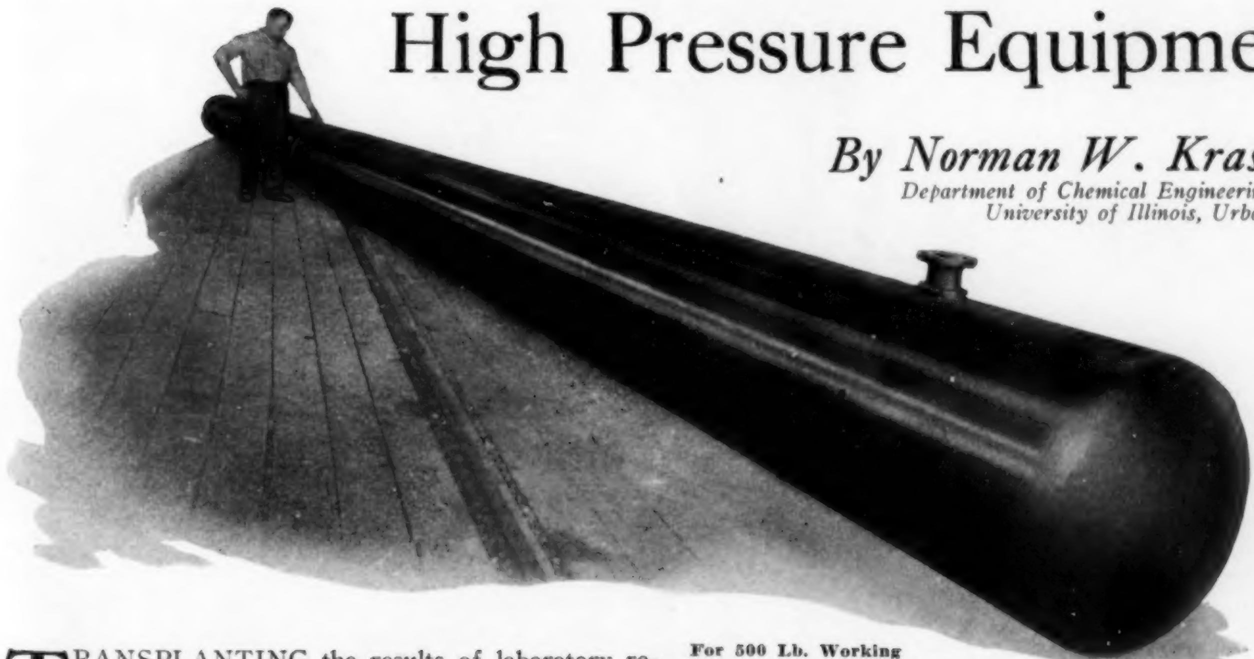
The editorial portfolio of Roeber and Parmelee is now passed on to Sidney D. Kirkpatrick, associate editor. By action of the Executive Committee, he becomes the responsible head of the editorial activities of *Chem. & Met.* He has prepared himself for this position through more than seven years of association with Mr. Parmelee in the editorial direction of the magazine. He first joined the staff in June, 1921, as assistant editor, and in June, 1925, became associate editor. He had previously served since 1917 with the chemical division of the United States Tariff Commission—this service having been interrupted by a year with the A.E.F. in France, and six months in France and Germany with the chemical and economic sections of the American Commission to Negotiate Peace. Prior to governmental service, Mr. Kirkpatrick had been a member of the chemical staff of the Illinois State Water Survey, which he joined in 1916, following his graduation in chemical engineering from the University of Illinois.

ELECTRIC WELDING

Joins the field in

High Pressure Equipment

By Norman W. Krase
Department of Chemical Engineering, University of Illinois, Urbana



For 500 Lb. Working Pressure, This 24-In. x 60-Ft. Gas Storage Tank Is Made From Gas Line Pipe

TRANSPLANTING the results of laboratory research from small scale experiments to commercial production inevitably gives rise to many problems. Not the least of these is the development of new equipment to meet the needs of processes requiring special conditions of temperature and pressure. Such processes are by no means unusual and, if the present trend of research and development is any indication, will be much more numerous in the near future. Perhaps the outstanding example of an industry that is based on chemical reactions at high temperature and pressure is oil cracking. The enormous production of gasoline makes necessary large units of special design capable of sustained operation under severe service conditions. Other developments such as ammonia and methanol synthesis have required special pressure equipment. In the heavy chemical industry numerous examples of the use of high pressure or temperature could be cited; these require autoclaves, stills, condensers, digesters, fractionating columns and so on, capable of operating at several hundred atmospheres pressure and in some cases as high as 900 deg. F. How are these demands for new equipment to be met?

Visitors to the A. O. Smith Corporation plant at Milwaukee, Wis., have an opportunity of learning at first hand how a very progressive concern has been able to enter the field of pressure equipment manufacture and make a significant contribution toward the solution of many problems in the process industries. This company started the manufacture of automobile frames in 1903 and today is the world's largest producer. In addition, the corporation manufactures welded steel pipe, and is the world's largest producer of cracking stills. Of particular interest to the chemical engineering industry, however, is the fact that the resources and experience of such a company are being applied to the industry's problems.

It requires only a rudimentary knowledge of mechanics to appreciate some of the difficulties in the fabrication of satisfactory and safe pressure vessels of large size. An oil cracking unit may be 6 to 10 feet in diameter and from 40 to 60 feet in length, with a shell thickness of 2 to 4 inches. In addition such a unit must have numerous pipe connections and manholes. The manufacture of a pressure vessel of this type at the A. O. Smith plant reveals many interesting and novel features. The raw material is steel plate. This is formed, while hot, into cylindrical sections of the desired diameter, making necessary a longitudinal joint. To fabricate a unit it is frequently necessary to make 10 or 12 of these

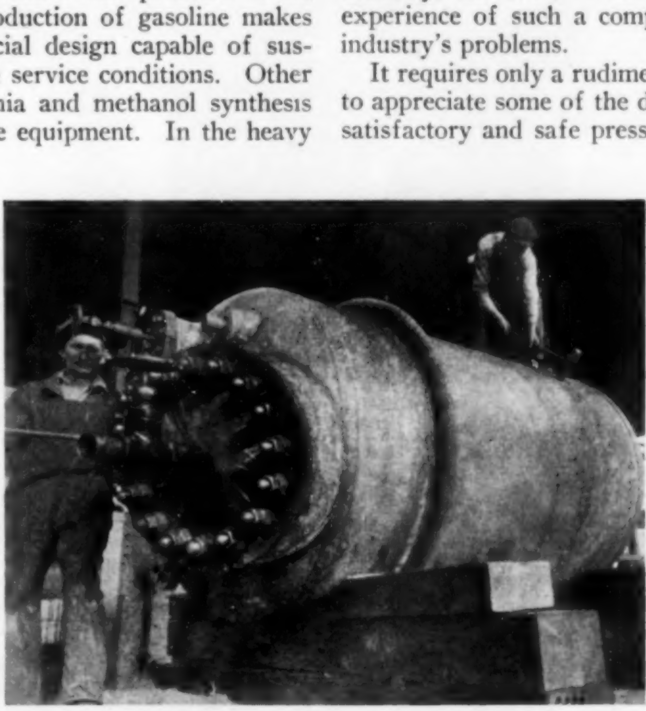
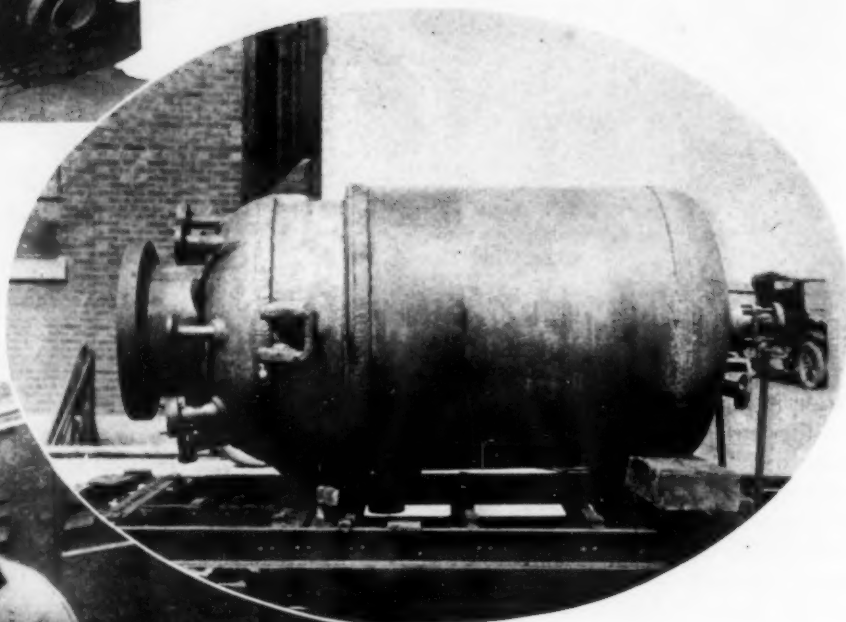


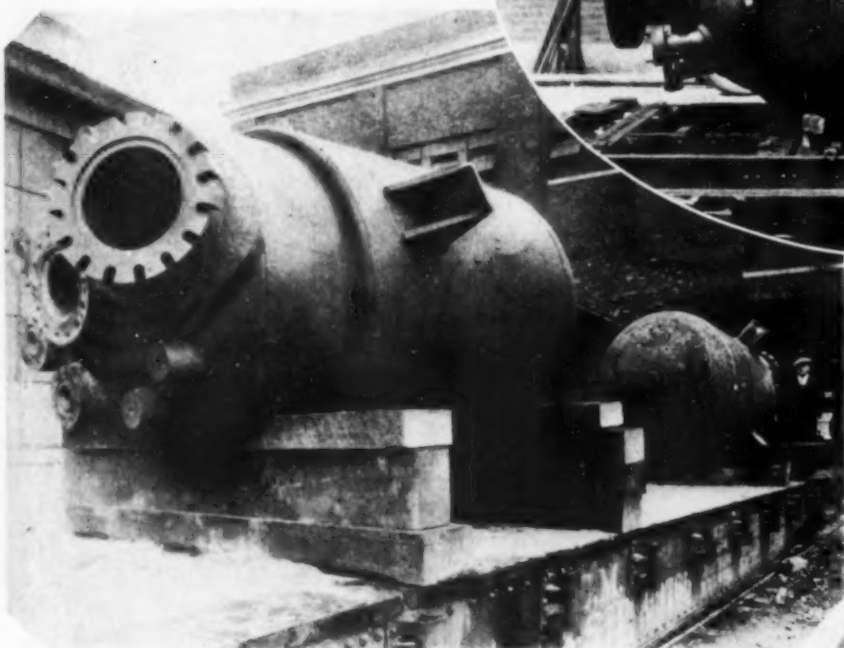
Fig. 2—Hammer-Testing a Welded Autoclave Under Pressure Prior to Welding on the Jacket

Various Pressure Vessels Fabricated by Special Arc Welding

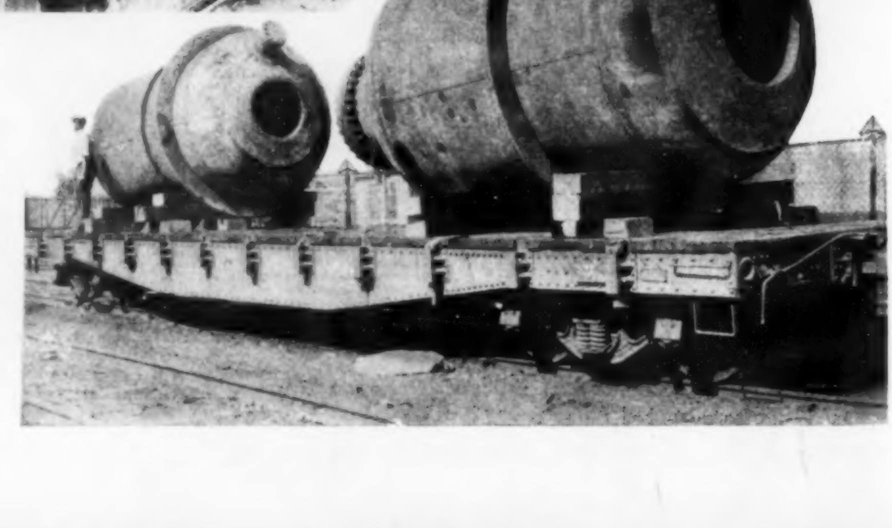
Above, jacketed autoclave of 1,000 lb. capacity; length 11 ft., inside diameter 6 ft., wall thickness 3 in., approximate weight 43,000 lb.



Above, jacketed autoclave for 600 lb. pressure; length 9 ft., inside diameter 42 in., wall thickness $1\frac{7}{16}$ in., approximate weight 10,000 lb.



Above, jacketed autoclaves tested to 2,100 lb. pressure; capacity 800 gal., length 11 ft., inside diameter 54 in., wall thickness 3 in.



At the right, welded vapor generators; length 15 ft., inside diameter 7 ft., wall thickness $1\frac{1}{2}$ in., shipping weight 40,000 lb. each.

sections. All joints are electric arc welded by a patented Smith process. After the several longitudinal welds in the sections have been made, the cylinders are placed end to end and electrically welded to form a single, open ended cylinder. The end pieces of such a unit are likewise

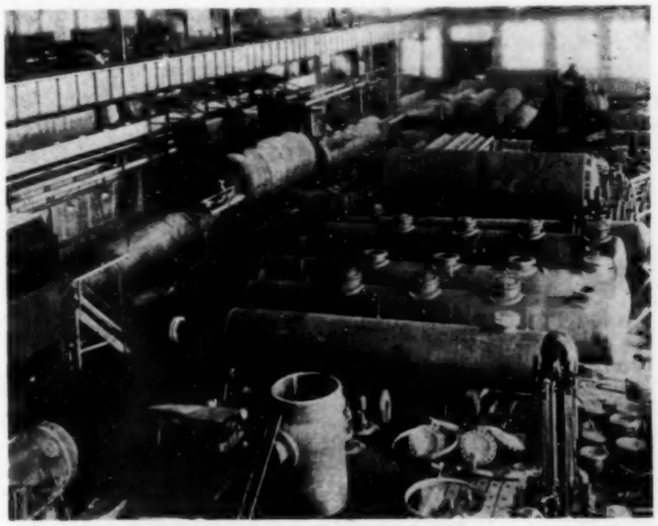


Fig. 3—Three Cracking Units Are Made per Day in This Shop

formed from steel plate. These are spun or pressed into the desired ellipsoidal shape and welded to the main body of the vessel. The openings necessary in the unit are reinforced by welding on steel rings around the hole to compensate for the reduction in strength due to the metal removed. Connections may be welded or flanged and bolted.

After the unit has been completed, it is placed in a huge electrically heated oven and the temperature raised to about 1,200 deg. F., where the stresses incident to welding and forming relieve themselves. This operation is, strictly speaking, not annealing, but is for the

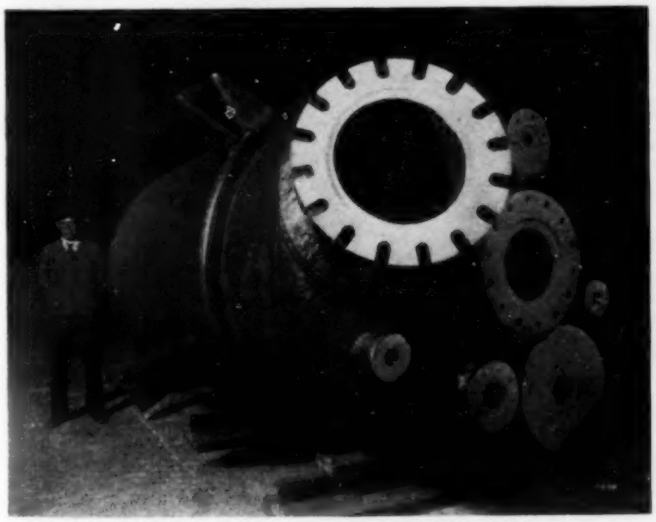


Fig. 4—One of the Largest Autoclaves Ever Built
Length 11 ft., inside diameter 54 in., main shell 3 in., jacket shell 2 in., working pressure 1,000 lb., shipping weight 35,000 lb.

purpose of relieving the major stresses due to local heating and working. From the oven, the unit is moved to a regulated cooling chamber, where its rate of cooling may be controlled as desired. The fabrication of the vessel is now complete. It is not ready for delivery, however. Every pressure vessel that leaves the plant of the A. O. Smith Corporation is tested. The details of the tests are of considerable interest, inasmuch as they reveal pertinent differences between welded and riveted construction.

The vessel to be tested is filled with a special penetrating oil and is pumped up to a hydraulic pressure usually three times the working pressure of the unit when in operation. With welded joints it is possible to go to much higher test pressures than is the case with riveted vessels. The upper limit in the latter case is, of course, only a small fraction of the yield point of the particular steel used. If too great a stress is applied, the body changes shape and the rivet joints are no longer tight. In other words, under stress the surfaces of the rivet body and the rivet hole can move with respect to each other and therefore open up leaks. In the case of all-welded construction, however, it is feasible to use stresses as high as 75 per cent of the yield point, in testing, with no harmful results. This, of course, gives a higher factor of real safety and this is of tremendous importance in the handling of hazardous materials in the chemical industry.

In Fig. 2 is a photograph of a welded autoclave during a test. The oil used for hydraulic testing is superior to water in revealing the smallest pin-hole leak and,

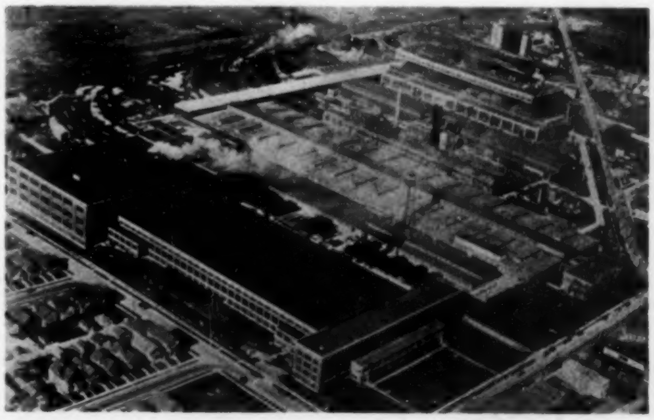


Fig. 5—A. O. Smith Corporation Plant From the Air

therefore, gives greater assurance that the body will be tight in actual use. While the pressure is on, the vessel is hammer-tested. That is, the welded joints and all parts of the body are struck with a sledge to reveal incipient cracks, and to give practically a "service" test. This hammering is not indiscriminate and left to the judgment of the workman, but is a definite, calculated stress placed on the metal in proportion to its ability to withstand the stress for which the vessel has been designed. The energy of the hammer blows in foot-pounds is made at least equal to the weight in pounds per square foot of the metal being tested. This method, therefore, provides uniform, severe testing of all equipment that is shipped from the plant. Fig. 3 is a general view of the still shop. The capacity of this shop is about three cracking units per day.

The method of manufacture of oil cracking stills, which has been briefly described, is applicable to any size and shape of vessel conceivable. Plates 6 inches thick can be worked and welded, and the size and weight of the finished unit is limited only by the transportation facilities. One of the largest single pressure vessels ever constructed by this process—or any other—is 70 feet long and weighs about 200 tons. Larger or heavier

units would probably have to be constructed in sections, then assembled and welded in the field. Fig. 4 shows one of the largest autoclaves ever constructed. The wall thickness is 3 inches. This illustration clearly shows

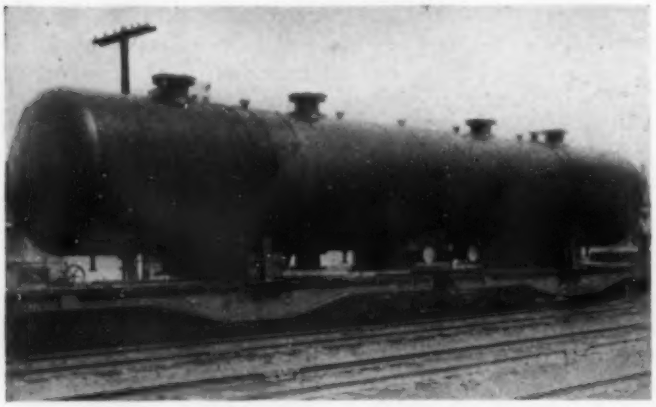


Fig. 6—Largest High Pressure Cracking Vessel in the World
Length 67 ft., inside diameter 10 ft., shell thickness 3½ in., shipping weight 366,000 lb.

the method of reinforcing openings and the feasibility of constructing special shapes of chemical equipment by the welding process.

Of the many novel and interesting operations to be seen at the Smith plant, perhaps the most important is

Fig. 7—Welded Pressure Vessel for Special Service
Length 22 ft., inside diameter 3½ ft., wall thickness 1 in., approximate weight 13,300 lb.

electric arc welding itself. The fabrication of pressure vessels of uniform thickness of metal with no overlapping seams or joints is a tremendous advance. This means that the rate of heat conductivity is the same in all parts and this tends to reduce stresses set up by temperature differences. Contrary to common conception, the welded joint, as produced by the Smithweld patented process, may always be made stronger than the plate metal itself. This, of course, is dependent upon exact knowledge of the composition of the metal used in the weld and on expert technique. Not only is the weld of greater strength, but it is also of a minimum ductility represented by an elongation of 25 per cent in 2 inches. These facts are susceptible of experimental verification and may be shown as follows.

In studying the design of new pressure vessels, and even in routine testing, it is frequently desirable to increase the test pressure to the bursting point. At intervals, large vessels are purposely broken by hydraulic pressure. The change in shape during such a test is carefully followed by the use of strain gages and other devices. These measurements also locate the point of initial failure. If a welded joint is weaker than the adjacent metal, the crack or rupture would originate in, or at least follow, the line of the weld. In all normal welds by the Smith process, rupture cracks neither originate in, nor follow welds. In the case of a specimen observed by the writer, failure occurred in the head of the unit, crossed the weld, and curved away from the longitudinal welded seam. These results show conclu-

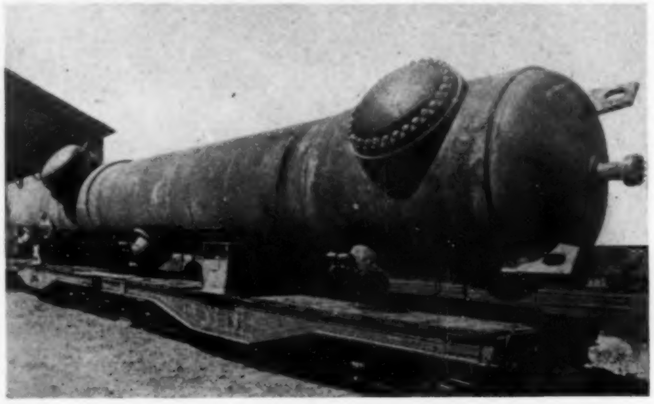


Fig. 8—Testing High Pressure Oil Cracking Still

sively that welding of pressure vessels can be an entirely satisfactory method of fabrication.

It is possible to obtain some indication of the ductility of the weld simply by observing the machining of the ends of a welded cylinder. It is found that the curl of the chip is not changed as the cutting tool passes through

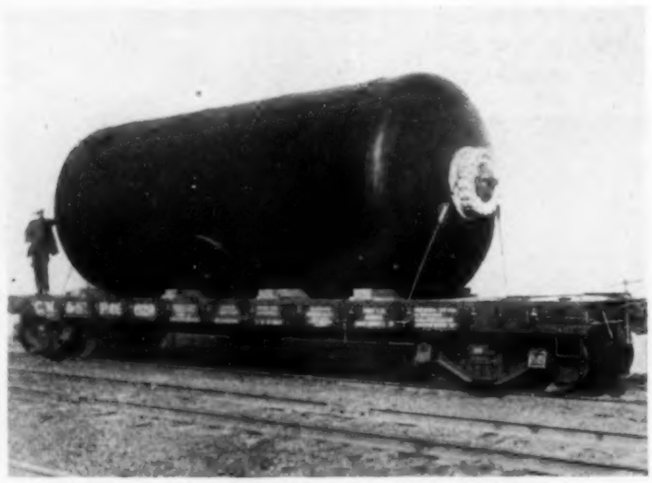


Fig. 9—Tumbling Digester for Paper Mill

the welded region. This also satisfies the important requirement that the weld be as readily machineable as the metal itself.

Of outstanding importance to the chemical engineering industries is the knowledge that large units of any design can be constructed to operate under conditions of temperature and pressure that formerly were incapable of approach. This is a most hopeful prospect for research men who are developing processes requiring extremes of temperature and pressure, and should assist materially in bringing into production many such new developments.

New Technology Emphasized in Gas Industry

A.G.A. convention considers fundamentals determining gas-plant design and operation

Editorial Staff Report

GAS ENGINEERING is becoming more closely allied to chemical engineering every year, if one may infer the trend from the character of technical discussion at the annual meetings of the American Gas Association. This tendency is evidenced not alone by the types of equipment and the plant-operating methods in use; it is also evident from the fundamental studies of economic relations and process control which now stand in the foreground of problems receiving the attention of the gas industry. The address of the chairman of the technical section, Walter C. Beckjord, at several points stresses the new research and engineering methods which are gaining increasing acceptance among management as well as engineering executives of the industry.

In his opening address Beckjord pointed out that changes must come slowly in an industry of the magnitude of the gas business, but that change is inevitable and "There must be courage to go ahead with new ideas and work them out in actual practice." Among the novel developments mentioned in this address and further discussed in the proceedings of the technical section were outdoor construction of plant equipment; utilization of new forms of gas; delivery of a completely dehydrated gas; increase in rate of capital turn-over, perhaps by off-peak use of water-gas equipment for making chemicals; and selection of plant types and equipment which, according to the best chemical engineering analysis, offer the optimum possibilities for profitable operation.

THE economic and engineering survey of the gas industry which has been carried out by a special committee under the chairmanship of H. E. Bates has done much to stress these important trends. It has brought to the fore particularly the problem of efficient making of a mixed gas which can be supplied without creating new customer troubles. This gas mixture is usually assumed to have coal gas as a base-load supply and to include water gas in varying proportions according to the send-out requirements. The variation in chemical composition of such mixed gas occasions a corresponding variation in the properties, especially the specific gravity, and the gas burner performance.

New emphasis is now given to the advantages of producing and distributing a gas of as low specific gravity as possible in order to increase the gas-handling capacity of equipment and pipe lines. This committee indicates the relative capacity of pipes for transmitting gas of different specific gravities as follows:

Specific Gravity	Capacity Ratio
0.70	1.000
0.65	1.037
0.60	1.081
0.55	1.128
0.50	1.184
0.45	1.248
0.40	1.323

It is pointed out that one of the most effective ways in which to reduce investment, or to prevent increases in investment, is to utilize this low-gravity gas to the maximum practicable extent. In this connection it should be noted that coal gas has a specific gravity of 0.4 or less, whereas carburetted water gas is usually of approximately 0.65 gravity. The gas-handling capacity of a system using coal gas would, therefore, be nearly 30 per cent greater than the same system transmitting water gas. The importance of this factor is particularly evident when one realizes that about 60 per cent of the total investment of the gas industry is in distribution systems and only about 40 per cent in the gas-making plant. Furthermore, with the tremendous increases in distances over which both manufactured and natural gas are being transmitted there is prospect that the proportion of investment in transmission and distribution facilities will still further increase.

WITH the threat of still further increase in the fluctuation of demand for gas between summer and winter, caused by increases in house-heating, the industry has renewed its effort to find means for utilizing the gas-making facilities during the periods of low load. A special committee of the Association, under A. C. Fieldner as chairman, has considered the possibilities of using such idle blue-gas plants for making hydrogen or mixtures of hydrogen and carbon monoxide to be used in ammonia or methanol systhesis. Their conclusions of the preceding year (*Chem. & Met.* Vol. 34, p. 675, 1927) are again confirmed. In fact, the committee believes that the general situation is "somewhat more unfavorable than last year due to the plans of increased production by the large chemical companies." They also cite as obstacles in the way of such use of water-gas capacity the prospective manufacture of such chemicals from natural gas or from petroleum on a more profitable basis. Their most optimistic conclusion is:

"A possible chance for utilizing a synthetic process by gas companies is in the catalytic enrichment of water gas by the Fischer process. Research work along these lines may be justified at the present time since it would make

gas companies independent of the petroleum industry. With increasing gasoline demand and decreasing petroleum supply, gas oil will be required as cracking stock for gasoline production. It is recommended that the Association foster an inquiry on the probable cost of synthetic enrichment of water gas, and a comparison of this cost with costs of carburetting with oil, in order to determine whether or not support by the Association of research on catalytic enrichment may probably be justified."

DEHYDRATION of gas for city supply has been talked of for some years, but only within the past twelve months has the first city-wide distribution of such gas been accomplished. This was carried out by installation of a new drying system in the works of the Grand Rapids Gas Light Company, using the hygroscopic solution method. The hygroscopic solution employed was obtained as a by-product of liquid purification (sulphur removal) and consists of sodium thiocyanate and sodium thiosulphate in aqueous solution. The gas leaving the iron oxide purifiers is passed through a scrubbing tower in which this hygroscopic liquor trickles over grids. The dried gas is then sprayed with oil in order to remove entrained solution and at the same time create in the gas a small amount of oil fog and oil vapor. The purpose of this oil treatment is in part to keep the distribution system moist with a slight quantity of oil and thus prevent dust formation and prevent the development of many leaks in joints which would otherwise dry out completely when the dehydrated gas passed through them. To prevent the dried gas from taking up water in the storage holder a layer of oil is maintained on the water surface of the water-sealed holder, considerably reducing the partial pressure of the water.

The report on this system and of the advantages and costs of operation of such plants is that of a sub-committee under the chairmanship of F. W. Sperr, Jr. The committee points out that drying need not be carried out to zero water content. The moisture need be reduced only to the point at which the gas has a dew point of one or two degrees below the minimum temperature of the part of the distribution system which is to be protected. Under most circumstances a dew point of 30 deg. F. is adequate, but in a few exceptional cases a lower dew point may be justified by increased savings resulting from the elimination of all possibility of freeze-ups.

THE committee recommends that a study be made of ground temperatures to determine the extent of dehydration required in different parts of the country. They also suggest the possibility that with dried gas the laying of mains and services above the frost line may prove feasible, thereby greatly reducing the costs of construction of distribution systems through decrease in the necessary trench depth.

Cost of gas dehydration has been worked out by this committee for three systems using respectively refrigeration, compression, and hygroscopic brine. Their technical analysis will be summarized in article form in an early issue of *Chem. and Met.* The conclusions there given and the cost data appear to be significant not only for city-gas dehydration, but for general application in chemical engineering work. In another later issue there will also be given the deserved attention to the important report of the water-gas committee, which discussed many of the recent developments in automatic operation in this important branch of the industry. Automatic charging, automatic clinkering, and improved operating practice in gas plants generally, will form the subject of the latter discussion.

NEW methods of gas making, offering prospective advantages in economy or in quality of products, are always of concern to the gas industry. The sub-committee on low-temperature carbonization and complete gasification of bituminous coal this year, as on former occasions, reviewed a substantial number of such processes. This committee, however, departed from its former custom in making something of an economic interpretation of the trend. The committee points out that the status of low-temperature coking has remained essentially unaltered during the past year and that in only one case are there prospects of full commercial-scale operation of a low-temperature unit. The one exception is the K.S.G. plant now nearing completion near New Brunswick, New Jersey. The sub-committee summarizes current judgment on this matter in the following language:

"In general there seems to be no concordant body of opinion in the United States as to the proper ultimate niche for low-temperature carbonization in our general scheme of fuel utilization. . . . This uncertainty arises largely from the fact that we do not actually know the final large-scale market value of low-temperature tar as compared to coke-oven and other existing tars, or that of low-temperature semi-coke as compared to by-product coke on the one hand and anthracite coal on the other. In this respect we find ourselves caught in a vicious circle. These final values cannot possibly be established save by continued commercial scale operation, yet such operation cannot be projected or established on any sound financial basis unless these values are definitely known.

ANOTHER new system of gas making was proposed in a paper by R. W. Thomas and O. M. Setrum, of the Phillips Petroleum Company organization, who advocate propane and butane as city-gas enrichers. Many of their conclusions are based upon experimental use of this material, first at Muscatine, Iowa and currently at Davenport, Iowa, in both cases in plants of the United Light and Power Company. That plant work has demonstrated the technologic feasibility of enriching blue water gas with these hydrocarbons instead of by the customary cracking of oil in contact with the hot gases in the carbureter.

The use of these materials, it is claimed, affords a constant-quality enricher, all of which can be used in the gas without requiring any heat for cracking. A system using propane and butane is very flexible, affording special advantages with changing load conditions. Since no carburetting of the gas with cracked gas oil is required there is more heat available for waste-heat boiler use, there are no re-checkering problems, and certain other incidental expenses due to oil pumping, pre-heating, etc., are eliminated.

Offsetting these advantages are certain increases in cost due to the requirement of high-pressure storage of these light hydrocarbons and the decreased gas-making capacity of existing water-gas sets. There is also a distinct disadvantage incident to the increasing specific gravity of the gas enriched with propane or butane and

there are, of course, no light-oil or tar credits obtainable for such a system. Despite these disadvantages, the proponents of the new process conclude that commercial butanes are at present competitive with gas oil for water-gas enrichment. They emphasize the relatively greater worth in the event of increased prices for gas oil. The discussion of this subject brought out the fact, one of considerable importance to the city-gas man, that these hydrocarbons are available commercially and if they are not utilized for enriching city gas they will undoubtedly be marketed as a competitive fuel, perhaps in part replacing city gas for industrial use.

LEATHER for gas-meter diaphragms has long been a problem of concern, not only to the meter maker, but also to the city gas works. A two-year research on the causes of premature deterioration was reported by J. F. Anthes, of the Brooklyn Union Gas Company. His investigations show that deteriorated meter diaphragms usually contain considerable iron and sulphur, but insufficient sulphuric acid to account for the deterioration noted. All but one of the vegetable-tanned leathers were very greatly weakened by exposure to moisture in gas containing hydrogen sulphide when in the presence of tinned iron. Even in the absence of the hydrogen sulphide some deterioration was noted in every case but the one. The one resistant vegetable-tanned leather was found to contain only pyrogallol tannin.

Semi-chrome leathers were found more resistant, either in the presence of or the absence of hydrogen sulphide. Moreover, neither the vegetable or chrome-tanned leathers seemed to be affected by dry gas, even in the presence of both hydrogen sulphide and tinned iron. Moisture and tinned iron are both apparently essential factors in producing deterioration noted of vegetable-tanned leathers. Similarly, presence of water seems necessary to produce the attack noted in the presence of ammonia vapor in the gas. In the case of ammonia attacked vegetable-tanned leather suffers much more than chrome-tanned.

On the basis of the observations made, it is recommended that semi-chrome leather be used in place of vegetable-tanned leather for gas-meter diaphragms. Skins used should be reasonably free from grain defects and tick and from flaying defects, and, of course, from holes. Leather to be satisfactory should contain at least 3.0 per cent of Cr_2O_3 on the dry grease-free basis and should satisfactorily withstand immersion in boiling water for at least five minutes, and preferable for 15 minutes. The author also states:

"Although semi-chrome-tanned leather has been found to be highly resistant to deterioration, nevertheless great care and discretion must be exercised in its purchase. There are many leathers on the market today which, while sold as semi-chrome stock, are decidedly inferior to a good grade of vegetable-tanned leather. The mere presence of chromium in a leather is by no means a guarantee that the leather has been properly tanned. In order to produce a well-tanned skin the chromium must not only be present in sufficient quantity, but it must also be combined with the collagen in such manner as to produce a substance which will be unaffected by boiling water."

THE theoretically correct gas plant for any locality is, of course, desired by every management. A preliminary survey of the considerations for determining such plant was presented by Frank W. Steere, of the Semet Solvay Engineering Corporation in the form of four elaborate and detailed examples worked out to show how a management can analyze this basic problem in plant selection. In this article the author undertook to give a clear and simple mathematical basis for estimating the best equipment and the best process for any locality when the local conditions prevailing there are known.

The object of the discussion was to compare the total cost of gas with all capital charges, including 8 per cent return on investment, which would result from different manufacturing processes. Among the factors considered and reduced to mathematical relationship in the paper are: annual make, generating capacity, load factor, cost of gas-making material, coke credits, other by-product credits, conversion (operating) costs, investment per thousand feet of gas, depreciation, and administrative, general, and other fixed charges.

FOUR cases chosen for calculation were: I. A straight coal-gas plant; II. A carburetted-water-gas plant; III. A mixed-gas plant with coal-gas base load and carburetted-water-gas to adjust to send-out requirements; and IV. A similar mixed-gas property, but with the coal-gas plant using producer gas for under-firing instead of oven gas. The conditions chosen for the illustration, assumed to be typical of conditions prevailing in many parts of the country, were for a send-out of 1,580,000 M. per year of 530 B.t.u. gas. Prices used were: gas coal, $5 per ton; boiler coal, $4; gas oil, six cents per gal.; and credits for coal-gas tar, 5.5 cents per gal.; water-gas tar, 4 cents per gal.; and ammonium sulphate, 0.375 cents per lb. after deducting the cost of acid and lime. A characteristic seasonal load curve, accurately defined by the author, was assumed to govern works operations.

In all but the case of straight water gas the resulting cost per M., including capital charges and with proper credits for by-products, was more affected by the price of coke than by any other single factor. For example, in case I. the resulting gas cost ranged from 71.6 to 26.3 cents per M. as the value of coke varied from $5 to $10 per ton. In general, it was concluded that if coke can be marketed for $2 per ton more than the cost of the coal, then the cost of gas in all the cases assumed does not vary greatly from the cost of water gas. When the coke is less advantageously marketable, coal gas becomes higher than water gas; conversely, with a favorable coke market coal gas has a distinct price advantage over the former.

AS A generalization Steere concludes that the three outstanding factors in the cost of gas are the coke market, the load factor, and the initial investment required. He points out that changing economic relations may radically modify the relative advantages of different systems. He therefore urges that every management be alert to analyze this local problem according to some such scheme as that set forth. Specifically, he warns against concluding as a broad generalization that coal gas is necessarily the proper base-load gas. Although this conclusion may be warranted for many, or even most, plants, it is not necessarily correct for all. Hence, he says, "The gas industry, like most other industries, has reached the point where every factor must be thoroughly understood and accurately analyzed before a final conclusion is reached. While the figures here given are set up on a more or less theoretical basis, I feel that the information which they reflect justifies a further and more exhaustive study along this line."

How Direct-Current Power is Made for Electrolytic Processes

By E. B. Dawson

General Engineer, Westinghouse Electric & Manufacturing Company

EXPANDING use of electrolytic processes for the production or refining of such materials as zinc, copper, caustic soda, chlorine, aluminum, hydrogen, and oxygen, requires an ever-increasing amount of direct-current power. On the average 200,000 kw. capacity is probably a fair estimate of the world's annual purchase of direct-current machines for electrolytic service. If we consider that these machines operate at 80 to 90 per cent load factor it is evident that a very large amount of power is used in electrolytic processes.

Power cost is an important part of the total cost of materials produced by the electrolytic processes. The following table shows the cost of power per pound of product based on power at one-half cent per kw.-hr. This table is not representative of cases where there is a market for all products. In these cases the cost should be distributed properly.

	Lb. per Kw.-Hr.	Cents per Lb. (0.5 Cent per Kw.-Hr.)
1. Hydrogen	0.035 (6.7 cu.ft.)	14.2
Oxygen	0.28 (3.34 cu.ft.)	1.79
2. Zinc	0.5	1.00
3. Copper:		
Extraction	0.65 to 1.00	0.77 to 0.5
Refining	0.8	0.062
4. Aluminum	0.066	7.6
5. Caustic soda	0.6	0.83
Chlorine	0.55 (2.96 cu.ft.)	0.91
Hydrogen	0.0015 (0.29 cu.ft.)	33.4

Since the power cost is in many cases a considerable percentage of the value added to the material in the plant the need for low-cost power is obvious.

The equipment selected to produce direct-current power affects the power cost through the capital charges and the losses. A comparison of the cost and performance of the various means of obtaining direct-current power is necessary before purchasing equipment for an electrolytic plant.

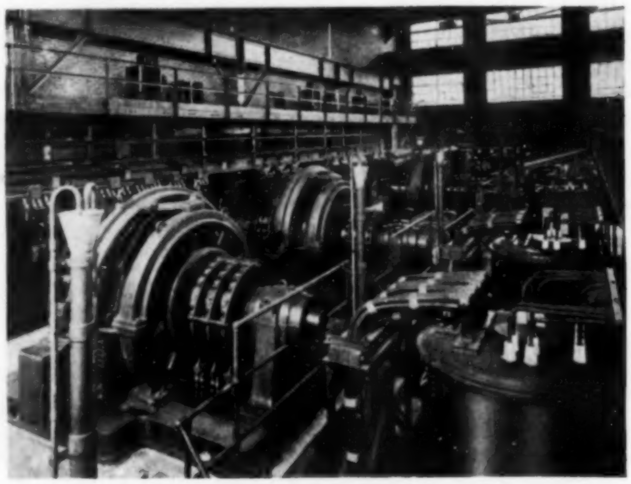


Fig. 2—Booster Converters With Voltage Range of 62-126 Volts
This installation of 954 kw. converters operating at 110 volts, 8,670 amps., 6 phase, 25 cycles and 300 r.p.m. gives some idea of the large amount of power required for the refining of copper and other metals by electrolytic processes.

Direct-current power can be obtained in several ways:

1. Purchased alternating current converted to direct current by:
   a. Synchronous converters.
   b. Motor-generator sets.
   c. Rectifiers.
2. Generated power:
   a. Alternating-current generation and conversion as for purchased power.
   b. Direct-current generation.
      1. Geared steam turbines.
      2. Steam engines.
      3. Diesel engines.

The bulk of the direct-current power is obtained from synchronous converters or motor-generator sets. A few geared steam turbines are in operation. A number of steam engines are operating but these are largely old machines. The Diesel engine has possibilities in certain districts. The mercury-arc rectifier may come into use, particularly for the higher voltages, as its development progresses.

When alternating-current power is purchased or generated it must be converted to direct current. If we exclude

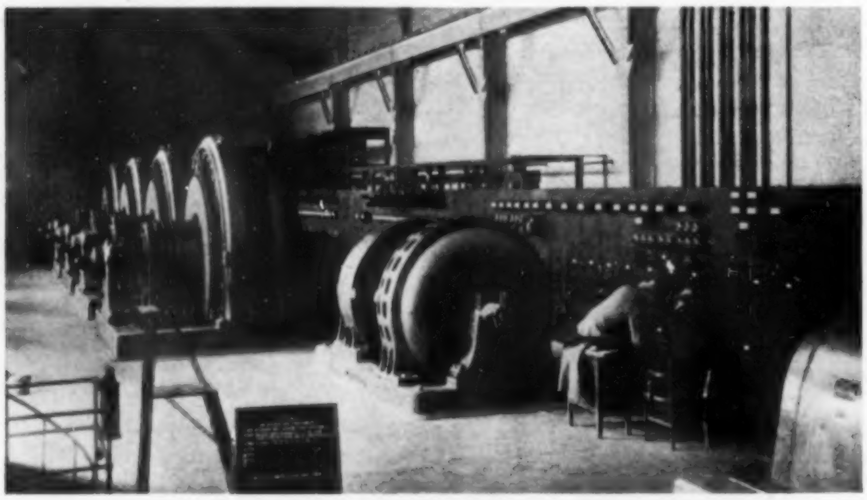


Fig. 1—Rotary Converters in the Largest Electrolytic Caustic Soda Plant in the United States
In the plant of Westvaco Chlorine Products, Inc., at South Charleston, W. Va., four Allis-Chalmers 3,250 kva. synchronous converters operating at 187 volts on a.c. side and 250 volts on the d.c. side supply the current for cell operation.

the mercury-arc rectifier, which has not been thoroughly tried in this service, the only machines available are the synchronous converter and the motor-generator set.

In some cases the choice between motor-generator sets and converters is obvious either because of the high power cost or because a wide voltage range is required. Other cases require careful analysis prior to a decision.

Factors affecting the choice between synchronous converters or motor-generator sets are:

1. Cost of power.
2. Transmission-line voltage.
3. Length and characteristics of the transmission line.
4. Requirements of the electrolytic circuit.

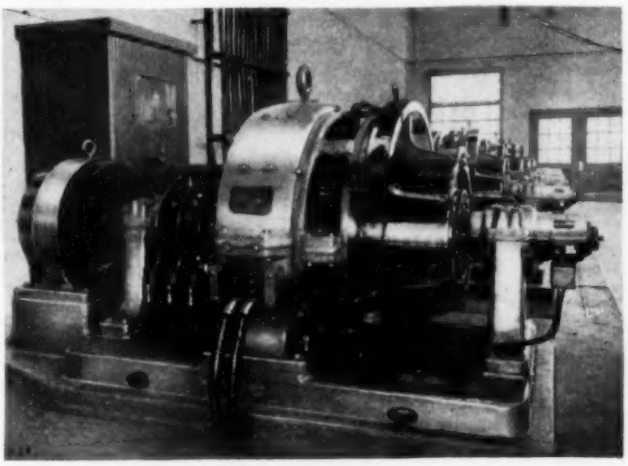


Fig. 3—View of Typical Booster Converter Installation
These machines are in use where direct-current power is made for electrolytic processes.

The cost of power is an important consideration because of the difference between the efficiency of the converter with the transformer and the motor-generator sets. Fig. 5 shows the efficiencies that may be expected. The converter efficiency shown on the curves includes: losses in the converter transformer and induction regulator calculated by the A.I.E.E. method and the calculated losses in the leads between the transformer and converter assuming twenty feet along the leads between the transformer and the converter.

Transmission-line voltage has a bearing on the cost and efficiency because where it is 13,200 volts or lower, motor-generator sets 1,000 kw. and larger can economically be operated direct from the line without step-down transformers. In this case, the synchronous converter with the transformer will cost, in the larger sizes, about the same as a motor-generator set and will be only about $1\frac{1}{2}$ per cent more efficient.

When the transmission voltage is higher than that for which the motor of the motor-generator set can be economically wound, i.e., 13,200 volts, the motor-generator set with its transformer becomes more expensive and about 3 per cent less efficient than the synchronous converter and its transformer and regulator.

If the transmission voltage is very high, 50,000 volts or more, and a larger number of machines are required, ten or more, the necessary high-tension switching for each converter unit becomes very expensive and it is most economical to use a double transformation. The voltage would be reduced to 6,600 or 13,200 volts, in one or two large transformer banks. The synchronous converter transformers or motor-generator sets would operate directly from the 6,600 or 13,200-volt bus. The problem then becomes the same as when power is purchased at these voltages.

Long high-voltage transmission lines may be subject to disturbances which are apt to be reflected through the synchronous converter and disturb commutation. In such cases, the use of motor-generator sets is first to be considered unless the amount of power and power cost are such that the $1\frac{1}{2}$ to 3 per cent difference in efficiency represents a sum sufficient to cover the probable higher operating and maintenance expenses.

The line characteristics may be such that a leading power-factor load will be desirable for the power system. Motor-generator sets can be built to operate at any leading power factor. Particularly when power is purchased, the power-factor correcting possibilities of the motor-generator set may overbalance any difference in first cost or efficiency in favor of converters.

Requirements of the electrolytic circuits are usually pretty definitely known. As a rule a voltage range of ten per cent plus and minus will be ample to meet all operating requirements. This range is easily obtained on the ordinary self-excited generator.

Control of the direct-current voltage of synchronous converters is not as simple as a direct-current generator. In order to vary the direct-current voltage of a synchronous converter it is necessary to vary the applied alternating-current voltage since there is a fixed ratio between the a.c. and d.c. voltages. The applied a.c. voltage can be varied by a direct-connected or separately driven alternating-current booster, by an induction regulator, by taps on the transformer, or by field control of the converter.

The induction regulator is probably the most satisfactory in most cases for voltage ranges of five per cent plus and minus or less. The booster converter is quite satisfactory and for some voltage ranges, particularly five to ten per cent plus and minus, will usually be cheaper but less efficient than the induction regulator. For large ranges of voltage control an induction regulator to operate between transformer taps is very satisfactory.

The use of a booster converter in conjunction with

Fig. 4—Synchronous Converters Used in Converting Alternating Current to Direct Current
Nine Westinghouse 2,500 kva. synchronous converters operating at 500 volts, 6 phase, 60 cycles and 400 r.p.m.

transformer taps to obtain a wide voltage range, or the use of field control with consequent operation at other than 100 per cent power factor, have been used successfully but in general are not recommended because of the tendency to disturb commutation and overheat the machine.

It is often desirable in the preliminary stages of a project to estimate the probable cost and performance of the electrolytic substation. The accompanying curves, Figs. 5, 6, and 7, show typical data on machines suitable for electrolytic service.

While this comparison of synchronous converters and motor-generator sets will be of use mostly when power is purchased, it applies equally well when alternating current is generated at a remote point.

If the desirability of generating power is considered, a number of alternate propositions must be assumed, such as:

1. Water power.
2. Steam power.
3. Diesel engines.

Regardless of the primary source of power considered, the power may be generated as alternating current and transmitted to a substation near the tank house or may be generated as direct current at a site near the tank house.

The relative economy of water-power generation is so dependent on the location and nature of the available site, it is difficult to draw any general conclusion. It is well known that a.c. generation by water power is often the most economical and that occasionally the water-power site and electrolytic plant site will be close enough so that direct-current power can be generated.

The bulk of the power generated at or near the electrolytic plant is steam power. The steam may be used in turbines to generate alternating-current power or in engines or geared turbines to generate direct-current power. Where the electrolytic power is a small proportion of the total plant load or where the power house cannot economically be located relatively near the tank house because of additional coal handling, pumping or other charges, the generation of alternating-current power in the conventional turbine is indicated, with subsequent conversion to direct current of the power used in electrolytic processes. Where the power house can be located near the tank house and where the bulk of the total load is used in electrolytic processes the generation of direct-current power would seem to be the simpler and more economical.

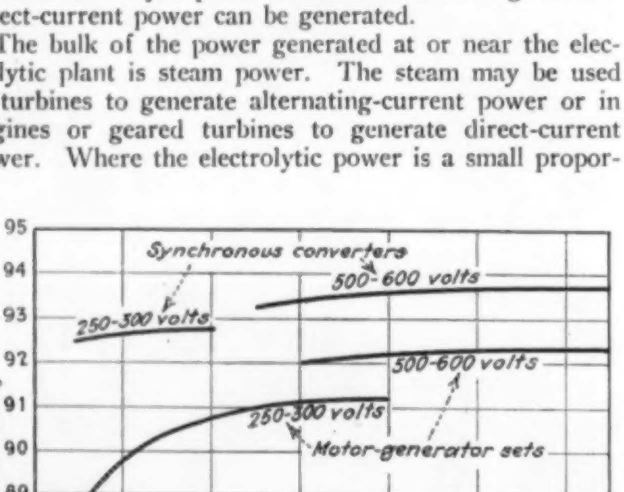


Fig. 5—Efficiency of Synchronous Converters and Motor-Generator Sets

Converter efficiency includes losses of transformer and induction regulator or booster and 0.3 per cent a.c. lead loss. Motor-generator set efficiency is based on 100 per cent power factor for motors. All losses are calculated or measured in accordance with the A.I.E.E. rules. The resulting efficiencies are close to the actual efficiencies.

Possibly the relative merits of alternating-current and direct-current generation can best be shown by summaries of analyses prepared recently. The first compares alternating-current and direct-current generation where the plant load will be 18,000-kw., 500-volt direct current and 6,000-kw., 440-volt, 3-phase, 60-cycle alternating current. The plants estimated include what is considered ample spare capacity. For instance, the 36,000-kw. plant will consist of four 9,000-kw. units, three of which will carry the 24,000-kw. load plus losses.

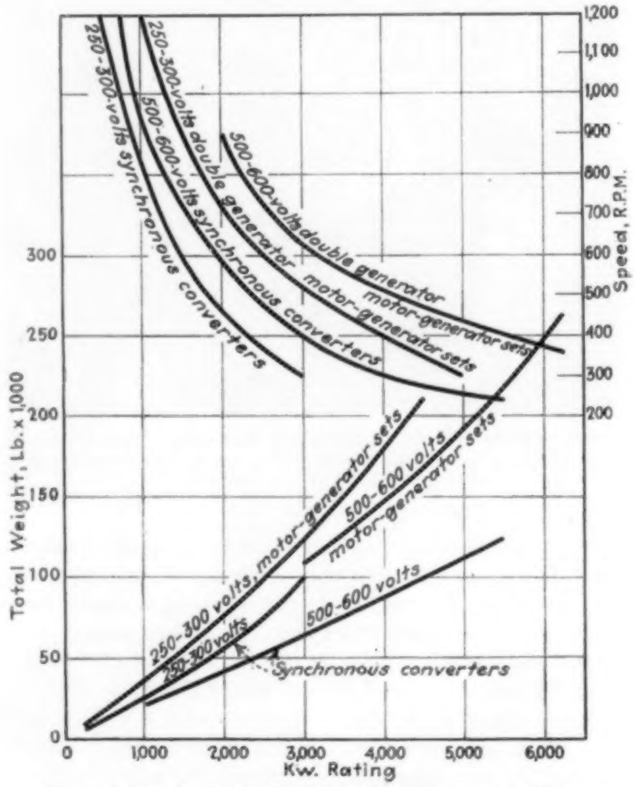


Fig. 6—Speed of Synchronous Converters and Motor-Generator Sets

Apparatus	A.C. Generation	D.C. Generation
36,000-kw. a.c. turbines, condensers, transformers, switchboard and motor-generator sets	$983,000	
Foundations, buildings, boilers, stokers, coal and ash handling, cranes, piping, stack, erection, etc	1,847,000	1,600,000
24,000 kw. geared turbine-driven d.c. generators, condensers, switchboard, transformers, 8,000-kw. in a.c. turbines and condensers. (Note: 3,000-kw. a.c. was available from other sources)	....	900,000
Total cost of plant exclusive of engineering and insurance	2,830,000	2,500,000
Tons of coal per year basis of guaranteed water rates, but exclusive of losses due to radiation, leaks, banked fires, etc	157,000	152,000

Another example required 2,800-kw. direct current for electrolytic service and 500-kw. direct or alternating current for miscellaneous power and includes spare units.

Apparatus	A.C. Generation	D.C. Generation
Two 3,750-kw. a.c. turbines, condensers, three 1,400-kw. motor-generator sets and switchboard	$265,000	....
Three 1,400-kw. d.c. turbine-driven generators, condensers, switchboard and one 500-kw. non-condensing geared d.c. turbine	....	$230,000
Steam per hour at average load, bleeding 10,000 lb.	43,000	41,000

The comparison of the two systems of power genera-

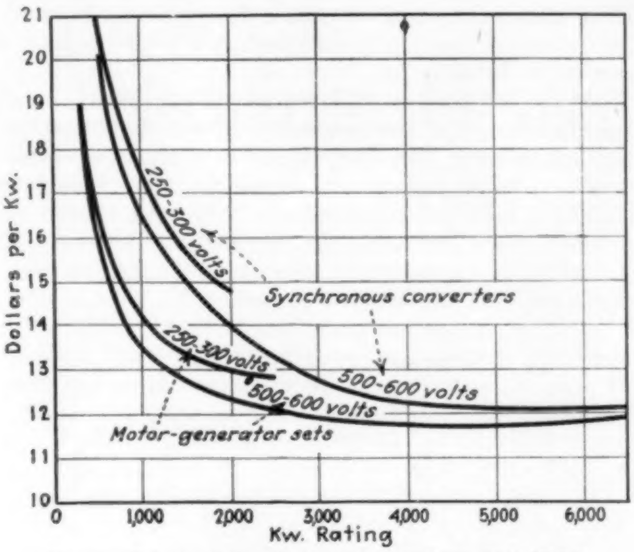


Fig. 7—Prices of Synchronous Converters and Motor-Generator Sets

Converter prices include converter, transformer and induction regulator or booster for 5 to 10 per cent plus and minus voltage range. Converter rated 40 deg. C. rise; transformers 55 deg. C. rise. Motor-generator prices cover 40 deg. C. generator and 50 deg. C., 100 per cent power factor, 3 phase, 60 cycle motor.

tion shows the following advantages and disadvantages of the geared direct-current turbine-driven generator compared to a'ternating-current generation.

1. Advantages:
   a. Lower first cost.
   b. Lower fuel cost.
   c. Lower labor cost.
   d. Probably lower maintenance.
2. Disadvantages:
   a. Lack of flexibility.
      1. Interconnection with other power systems.
      2. Conversion of plant to other than electrolytic use.
      3. Major changes in electrolytic circuits.
   b. Lower book value because of probable lower resale value.

As to any doubt regarding the reliability of gears there are millions of horsepower for ship propulsion transmitted through gears. Marine applications have been made up to at least 11,250 hp. per pinion. Probably the largest gear in electrolytic service is one single-reduction, single-pinion, ten-to-one reduction gear, driving two 1,400-kw., 360-r.p.m. direct-current generators. This unit, which has been in service over two years, has been operating 94 per cent of the time. The six per cent outage includes cleaning condensers, a general inspection of the unit and routine maintenance.

There appears to be a rather large field for the use of geared turbines, particularly for replacing or adding to engine-driven generating equipment, and in other plants where without extra cost the power plant can be located near the tank room.

The continued growth of the electrolytic industries will require large amounts of direct-current power and power-generating and converting apparatus. The service is perhaps the most exacting of any on electrical apparatus, because it must operate continuously at practically full load, often under unfavorable atmospheric or temperature conditions. After the most economical equipment has been selected it is important that the station design be such that the electrical apparatus can be kept free from dirt, and supplied with plenty of clean air at a reasonably uniform temperature.

In spite of the care the manufacturer may take in designing and building equipment for this severe service, troubles may be experienced unless the equipment is given sufficient care in service. The routine of every plant should include regular inspection and cleaning of the equipment which supplies the direct-current power without which the processes are not possible. Adequate routine inspection and maintenance will insure a steady supply of direct-current power without danger of curtailment of production because of trouble in the power plant or substation, thus leaving the management free to devote all energy to the electro-chemical and metallurgical processes, where, as a rule, greater technical advances and greater economies are possible than in the power house or substation.

Blau Gas Replaces Gasoline as Fuel in the Graf Zeppelin

WITH the final triumphant return of the Graf Zeppelin to Friedrichshafen, another and perhaps the most successful chapter so far has been written in lighter-than-air transportation. Several new features in airship construction and operation have been proved in strenuous practice, not the least interesting of which is the use of Blau gas as fuel on the flight to this country. While the return trip was made using a gas which did not exactly correspond to the usual analysis of Blau gas, it was very similar in its characteristics and equally successful, demonstrating still further the value of gaseous fuel in lighter-than-air flight.

Blau gas was developed by Herman Blau at Augsburg, Germany. Like the Pintsch gas so generally used before the widespread application of electricity to railroad lighting, Blau gas has ordinarily been compressed for use as a fuel and for lighting purposes in outlying districts. Ordinarily, the gas is made by cracking gas oil in a retort at the comparatively low temperature of 550 to 600 deg. C. The gas obtained consists largely of saturated hydrocarbons of the paraffine series but contains also a certain amount of unsaturates such as ethylene as well as some hydrogen. The calorific value averages about 1,800 B.t.u. per cu.ft.

It is understood that the Blau gas used in the Graf Zeppelin is quite similar to the fuel ordinarily known by this name with the exception that it is carried in fuel bags at a pressure very slightly above atmospheric instead of being compressed to liquefaction as is ordinarily the case. While Blau gas has a slightly higher heating value per pound than gasoline, the principal reason for its use in the Zeppelin was based on the interesting fact that its use enables the buoyancy of the airship to be maintained substantially constant without valving off the lifting gas. The specific gravity of Blau gas, referred to air, is 1.08. For this reason, as the contents of fuel bags is exhausted and the bags are collapsed by exterior air pressure, there is no appreciable change in the weight of the ship. On the other hand, when gasoline or other liquid fuel is used, the air which replaces the fuel burned is very much lighter than the latter, and in order to compensate for this decrease in the weight of the ship, it is necessary to release a part of the lifting gas. This, particularly in the case of helium, is very undesirable because of the high cost of the gas.

What Are the Facts About Sodium Phosphate?

EDITOR'S NOTE: *Few chemicals have attracted as wide interest in recent months as sodium phosphate. In this country it plays an important part in the whole phosphoric-acid situation which is now commanding international attention in connection with the development of concetrated fertilizer materials. The interesting data on this page were prepared from a preliminary statement just issued by the United States Tariff Commission as a part of its pending investigation under the provisions of the Tariff Act of 1922. On December 18 a public hearing will be held in Washington to discuss an application before the Commission for an increase in the present import duty on sodium phosphate.*

MANUFACTURE of sodium phosphate in the United States has increased steadily from a small industry in 1899, with an output of 4,630,000 lb., valued at $156,000, to an output of 158,600,000 lb. in 1925, valued at $5,758,488, and to 165,000,000 lb. in 1926, valued at $5,682,950. This expansion of the industry is due to the increased consumption of di-sodium phosphate by the silk industry, and to the growing use of tri-sodium phosphate as a cleaning agent. In 1925 there were 13 plants producing sodium phosphate of various kinds. Of these, five were engaged chiefly in manufacturing mono-sodium phosphate and acid sodium pyrophosphate for baking powders. Seven plants, operated by six companies, produced the entire output of commercial di- and tri-sodium phosphate. Early in 1926, one of these companies completed a new plant. In the summer of 1927, two more concerns commenced the manufacture of tri-sodium phosphate.

Methods of Production. Phosphoric acid is now manufactured by two methods: The sulphuric acid or "wet" process, and the pyrolytic or "dry" process.

Five of the six principal sodium phosphate producers make all or most of their own phosphoric acid; two of these five companies, each operating two plants, manufacture it in one and purchase it for the other. The Anaconda Copper Mining Company, which has developed extensive phosphate rock deposits in Wyoming and Idaho, producing superphosphates and phosphoric acid in order to afford an outlet for excess production of by-product sulphuric acid, supplies some phosphoric acid to sodium phosphate manufacturers.

The sulphuric acid method, the older and more widely used of the two, consists of treating ground phosphate rock with sulphuric acid, to which has been added some phosphoric acid, in order to decompose the rock into phosphoric acid and calcium sulphate. The calcium sulphate is separated out by filtration or flotation, yielding phosphoric acid of about 50 per cent strength, and containing impurities which are usually removed by treatment with other chemicals.

In the pyrolytic process, developed since 1920 and used by only one manufacturer of sodium phosphate (Federal Phosphorus Company at Anniston, Ala.), phosphate rock, sand, coke breeze, and iron and steel turnings are mixed in the proper proportions and fused in an electric furnace. Sufficient air is introduced to oxidize the phosphorus to phosphorus pentoxide. The fumes of phosphorus pentoxide, upon being passed through a chamber filled with a heavy mist or with fine spray of water, combine to form phosphoric acid. Electrical precipitation by means of a Cottrell precipitator yields phosphoric acid of about 85 per cent strength. Ferro phosphorus is also obtained as a joint product of the electric furnace.

Except for minor differences in purification and crystallization, the six producers of sodium phosphate from phosphoric acid use the same methods of manufacture. Mono-sodium or di-sodium is obtained by treating a solution of phosphoric acid with a soda ash solution. Solid impurities are removed by filtration. To produce di-salt some manufacturers use small quantities of caustic soda in addition to soda ash. The solution of mono- or di-sodium phosphate is then crystallized in mechanical or open pan crystallizers, either with or without previous concentration in vacuum, and excess water is removed by centrifuging. The crystals are dried in rotary driers, after which they are graded by screens according to fineness.

Tri-sodium phosphate is manufactured by treating the dilute solution of di-sodium phosphate with a solution of caustic soda, followed by a treatment which is similar to that given di-sodium phosphate.

TABLE I gives the output of sodium phosphate by grades in so far as separate figures are available. The 1923 and 1925 figures are from the Bureau of the Census; the 1926 figures were obtained by the U. S. Tariff Commission from the books of record of manufacturers of di- and tri-sodium phosphate.

Table I—Mono-, Di-, and Tri-sodium Phosphate Production in the United States, 1923, 1925 and 1926

	Mono- and Di-salt	Tri-salt	Total
1923 [1]			
Pounds	20,750,000	52,448,000	73,198,000
Value	$1,215,922	$1,955,632	$3,171,554
Cents per lb.	5.86	3.73	4.33
1925 [1]			
Pounds	61,122,000	97,566,000	158,688,000
Value	$2,467,387	$3,288,101	$5,758,488
Cents per lb.	4.03	3.37	3.63
1926 [2]			
Pounds	[3] 54,286,434	110,785,226	165,071,660
Value	[3] $1,784,862	$3,897,988	$5,682,950
Cents per lb.	[3] 3.29	3.52	3.44

[1] Bureau of the Census.
[2] U. S. Tariff Commission.
[3] Di-sodium phosphate only.

Relation of Production to Consumption. Domestic manufacturers supply more than 90 per cent of the annual consumption of sodium phosphate. In the period 1921 to 1925, imports amounted to less than 3 per cent of the apparent consumption, but in 1926 they were 5.2 per cent. The imports in 1927 show a large increase over 1926; production figures, however, are not available for 1927.

Table II shows the percentage of apparent consumption supplied by imports in 1914 and in each succeeding year for which production statistics are available. Exports being relatively small, consumption may be taken to be production plus imports.

Table II—Sodium Phosphate: Domestic Production, Imports for Consumption, Apparent Consumption and Percentage of Consumption Supplied by Imports, 1914-1926

Year	Production Pounds	Imports for Consumption Pounds	Apparent Consumption Pounds	Percentage of Apparent Consumption Supplied by Imports
1914	30,794,000	[1] 1,364,767	32,158,767	4.4
1917	26,610,000	[1] 1,561	26,611,561	...
1918	31,240,000	[1] 112	31,240,112	...
1919	44,702,000	56	44,702,056	...
1920	61,030,000	66	61,030,066	...
1921	56,428,000	1,274,938	57,702,938	2.3
1923	73,198,000	1,661,562	74,759,562	2.3
1925	158,688,000	4,500,220	163,188,220	2.8
1926	[2] 165,071,660	9,055,458	[3] 171,749,710	5.2
1927	....	16,770,555	....	...

[1] Fiscal year.
[2] Does not include monosodium phosphate.
[3] Exports of 2,377,408 pounds in 1926 deducted.

Storing, Distributing and Using HCl in the Plant

By Sidney Schein
Incandescent Lamp Department, General Electric Company, Harrison, N. J.

ONE OF the greatest sources of expense in chemical plants, or plants where chemical processing is carried on, is that of corrosion. During the last ten years there have been numerous alloys successfully developed for handling various corrosive solutions. There has been, however, no metal or alloy developed, commercially practicable, that will completely withstand the action of hydrochloric acid under the varying conditions experienced in the plant. For rigorous requirements where it is necessary to exclude the metals, then, there can be used for the transportation and distribution of HCl through the plant the following materials: stoneware, enameled steel, fused silica, glass, rubber (hard or soft), and wood. If we consider the handling of HCl at temperatures much higher than that of room temperature we are limited to stoneware, enameled steel, fused silica, glass and under special conditions, rubber lined steel. The handling of HCl may be divided into the several divisions, storage, distribution and processing.

Storage—The acid may be purchased in carboy, tank truck, or tank car lots. The method of purchasing is naturally dependent on the method of storage.

For storage purposes there can be used glass carboys, stoneware tanks, rubber covered steel or wood tanks, enameled or glass lined tanks and wooden tanks.

Carboys contain approximately 12 gal. or 120 lb. of concentrated HCl. As a general rule, this is the most expensive method of storage. The carboys must be filled; they are difficult to store economically, in that they necessitate a large area per unit quantity of acid; they must be loaded, unloaded, carried from stocking point to usage point in small units; and finally, the empty carboy goes through the same cycle. In addition, the cost of carboys, with which the consumer is charged while they are in his possession, can, and frequently does, amount to a considerable sum. Carboys are fragile, and while the per cent breakage is not high, it is still an item to be considered. Their chief advantage is their corrosion resistance.

UNDER the classification of stoneware may be considered the ceramic tank and the tank built up from ceramic tile, brick or sections. The first is limited in size. It cannot be subjected to rough service, for it is fragile; it is heavy and its first cost is rather high in proportion to its capacity. Its advantage is its corrosion resistance. The built-up tank does not have some of the disadvantages of the molded tank. Its resistance is limited by the cement used for joining. If properly and carefully built, such tanks are very satisfactory. They necessitate, however, a backing of either brick, concrete, or steel and are heavy and bulky, while their first cost is high.

Glass lined or enameled tanks have the advantage of lighter construction. They may be obtained up to 2,000 gal. capacity. If a suitable lining is used, they are practically indestructible from acid corrosion. Their first cost is high, and they have the disadvantage of lining fragility. They must be protected.

RUBBER lined tanks are the most modern type for the storage of HCl. Either hard or soft rubber linings may be used. The great preponderance of lined tanks have been those with soft rubber linings, as not until comparatively recently have hard rubber linings been satisfactory. Most of the trouble experienced in the past with hard linings has been the result of cracking, in many cases probably caused by temperature extremes, and due to poor joining at seams and openings. This has been overcome for the most part; one company claims an elongation of 20 per cent for its hard rubber lining. The soft rubber lining is claimed to withstand more abuse from rough usage and accidents than the hard rubber. This is true, but on the other hand, the soft rubber is constantly aging or vulcanizing in the acid, with the result that it often checks and crazes. The effect apparently does not penetrate much below the surface, however. Soft rubber lined tanks have been in service over ten years and are still in good condition. Hard rubber does not age. It has, however, the disadvantage of brittleness. With respect to cost, hard rubber linings are in general somewhat cheaper than soft rubber linings. There is practically no limit to the size of tank that can be lined. The cost of rubber lined tanks is moderate.

Wooden tanks may be used for the storage of HCl if it is not too concentrated. Quarter sawed cypress is the best material for this purpose. Acid up to specific gravity of 1.10 has been stored satisfactorily. For acids of higher concentration, it is necessary to treat the tank. There are a number of pitches and asphalts which may be used. The writer, however, prefers a paraffin. This is applied as hot as possible, taking pains to cover the surface thoroughly. The tank must be dry before coating, however. In one installation where the tank had been wet, several applications of diluted sodium silicate of high SiO_2 content, followed by an acid wash, proved satisfactory. In this case, the tank was washed to remove the soluble salts formed.

It is advisable to protect the steel hoops which tie the tank together. These may be made of acid-resisting alloys, they may be made of steel covered with tar, or other acid-proof paints. They may be held away from the tank by wooden wedges, or they may be of steel encased in an acid-resisting tube. One installation using steel hoops encased in lead pipe has proved very satisfactory. The threads and nuts are protected by a square

piece of lead sheet placed between the hoop and tank, and then folded back over the threaded end. This allows hoops to be tightened with very little trouble.

Acid storage tanks are better built without openings on side or bottom. On lined tanks this obviates difficult seams. If valves fail, as they sometimes do, a lower opening means loss of valuable material. The acid should be syphoned to the point of use, to the pump, or to the egg.

Distribution—There are several methods by which HCl may be distributed to the point of usage: by gravity, by dumping, by pumping, and by air pressure. There are also combinations of these methods. The first method is the simplest, the second usually the most expensive, and the last two the fastest and most positive.

In distributing HCl by gravity the limitations are obvious; the usage points must be below the level of the storage point. Wherever this procedure may be used, it is much superior from the cost and distribution viewpoint. If the proper system of distribution is used, there is little maintenance, and no trouble from failure or wear of moving parts. If large quantities of acid are handled and speed is desired, the first cost of the distribution system may be somewhat higher than that of the other systems, as larger lines must be used. Where time in handling acid is a small factor in the process, the usual size lines may be used and, consequently, this element is eliminated.

When it can be done safely, the storage of acid above the plant level is a very satisfactory arrangement. The tank can then be supplied with acid by means of a pump or air pressure and the acid then distributed by gravity, as the need demands. In a system of this type there is but one line under pump pressure, and that from pump to storage. Since this line is usually short and direct, it offers less opportunity for leakage and, consequently, less line maintenance work.

There is an added advantage in the gravity system, in, that if the lines are properly installed, they will always drain free. This removes the danger of acid pockets which may leak in time, or cause considerable trouble when lines are changed.

DUMPING of HCl from carboys or other containers is not only expensive but dangerous as well. It is the most primitive method and from a first cost viewpoint, the cheapest. In this case it is "not the first cost, but the upkeep." This method is usually employed only for handling small quantities. When dumping from carboys, notwithstanding extreme care, there is frequently introduced foreign matter such as pieces of glass, pieces of clay stoppers, and occasionally pieces of iron wire used to bind the stoppers. Labor for trucking, dumping and replacing carboys is expensive.

The use of air for distributing HCl is widespread. It is probably the most widely used method. The most commonly used apparatus is the acid egg or blow case. Occasionally, the air lift may be used, but it is only feasible in the plant for small lifts because of the high percentage of submergence necessary. (The percentage of submergence is the percentage of the total length of pipe which is immersed below the liquid supply level when pumping.) This averages for small lifts about 60 per cent. This means that to obtain a lift of ten feet, the lift bottom must be submerged approximately 15 feet below the level of the acid. The advantage of the air lift is its simplicity, its lack of moving parts, its ability to handle solutions containing solids, its low first cost. Such a lift may be constructed from glass, ceramic materials, and rubber lined or enameled steel.

The acid egg or blow case is a displacement apparatus. The air pressure is applied directly to the liquid in the tank. The simplest type consists of a single tank with means for charging, discharging, and air entrance, the valves operated manually. Another type consists of two displacement tanks, alternately filling and discharging. The compressed air valves may be operated manually, by floats, or by drop in air pressure on discharging of the contents. If the egg or case is below the storage level, the acid will flow in by gravity. If it is not, the tank may be connected to the suction side of the air compressor and the partial vacuum produced will cause the tank to fill. However, the more moving parts there are, the more trouble is usually experienced. Bearings and valves with metal parts corrode and freeze for there is usually more or less fume.

The early type of acid egg was usually of stoneware or similar ceramic material. For strength reasons they are usually built round or egg-shaped, and hence, their name. As such tanks are of comparatively low strength, they are usually surrounded by a protective cage, or are submerged. In addition, some form of safety valve is provided.

MORE modern eggs are often of rubber covered steel. These are not materially limited in size or shape. They might better be called blow cases. The average is designed for 60 pounds per square inch working pressure, although seldom in actual plant practice is this pressure used. It is possible to use the rubber lined storage tank for moving the acid, if it is designed for this purpose. In very large sized tanks this is wasteful of air.

Moving of acid by air necessitates a considerable outlay compared with other methods, if the plant is not already equipped with high pressure air, or if the high pressure air equipment is used for this purpose only. A compressor, compressed air storage tank, the necessary air lines and valves and the egg or blow case are necessary. If the primary storage tank is used the egg may be eliminated. Considering all factors such as cost, ease of operation, labor and space requirements, this last named method is best.

One disadvantage of acid distribution by air over that of pumping, is that there is more fume. Provision should be made for adequate ventilation or the egg or blow case should be in the open air.

There are several kinds of pumps that are satisfactory for pumping HCl. These are of some form of rubber, semi-hard or hard, rubber lined steel, or stoneware. The semi-hard rubbers are used as linings of casings supported by an acid-resisting alloy of steel. The hard rubber pumps are either molded as such, or are constructed from hard rubber and steel covered with hard rubber. These pumps are of the three usual types: centrifugal, piston and gear pumps. The centrifugal pumps will handle up to 200 gallons per minute at moderate lift and the piston pumps up to 100 gallons per minute. The gear pumps so far are only made in one size of approximately ten gallons per minute. The stoneware pumps are of the centrifugal and piston type. Their operating characteristics and capacities are similar to those of hard rubber. They have the disadvantage of being more bulky and fragile than the rubber pumps.

When properly designed, the rubber centrifugal pump is very satisfactory. The principal trouble has been in

obtaining tight stuffing boxes. When this difficulty has been overcome, or when provision has been made to take care of stuffing box leakage and to protect the shaft from corrosion, these pumps give very little trouble. They have large capacities under medium lifts, they are simple, take up very little space, and if properly and carefully installed, have a very low maintenance charge. Stoneware centrifugal pumps have very similar characteristics.

When installing centrifugal pumps, they should be placed below the level of the acid supply and the suction line should be as short and straight as possible. The interior pipe diameter on the suction side should be of full size. This precaution is especially to be noted in using rubber lined pipe, as the interior diameter of this pipe is smaller than the nominal diameter.

WITH higher lifts and greater discharge at high lifts the piston pump may be used. These are said to be able to operate satisfactorily under a considerable suction lift, but the writer's experience has been that more or less trouble is experienced unless acid is fed to the pump. This type of pump, in both stoneware and rubber, will operate under a maximum head of about 50 feet. There is one type of hard rubber pump which it is claimed will operate under a maximum head of 80 feet. The rubber pumps are made in capacities up to 100 g.p.m., the stoneware to approximately 80 g.p.m.

When installing positive displacement pumps it is good practice not to place valves on the discharge side of the pump. Serious accidents can occur by forgetting to open a discharge valve before starting the pump.

For transporting HCl to various points in the plant the following pipe materials may be used: glass, stoneware or tile, hard rubber, rubber lined steel pipes, and rubber hose. Under plant conditions where there is more or less vibration caused by various apparatus, there is difficulty in obtaining tight joints with the first three materials. If these are used, they must be braced and hung with extreme care. It is difficult to tighten joints sufficiently when using brittle materials. Even rubber lined steel pipe is liable to have leaky joints under extreme cases of vibration. In this situation some relief may be afforded by extra thick rubber gaskets. Under such severe service rubber hose has been successfully used. This hose consists of several impregnated canvas plies, covered outside with a medium weight casing of soft rubber, and containing a soft rubber lining. It can be hung in any manner. Joints are made by means of a hard rubber insert and metal clamps of acid-resisting alloy. Such a line has been in service over two years with no signs of deterioration and with no maintenance.

Steel pipe lined with soft rubber gives very satisfactory service under usual conditions. It is strong, gives tight joints, and no special care need be taken in hanging. The longest possible lengths between joints should be used to lessen the cost. This means, of course, a "tailor made" job. Glass and stoneware have the disadvantage of fragility and a greater number of joints per line. If set up with care and well braced there will be little trouble experienced under usual conditions. However, from the plant viewpoint, stoneware and glass are poor engineering materials. Hard rubber pipe is made in various thicknesses. The lighter material is not generally satisfactory for plant duty. All hard rubber has more or less tendency to creep on the straightways when loaded. It cannot, of course, be used for solutions other than specified by the manufacturer. It is rather difficult for the ordinary pipe-fitters to make tight joints with it.

Stoneware and rubber lined pipes are connected by means of flanged joints, using rubber gaskets. Glass, such as Pyrex, uses a specially constructed joint. Hard rubber is usually made with screw threads.

The following types of valves may be satisfactorily used: stoneware, hard rubber, and rubber lined valves. Stoneware valves have the usual disadvantage of fragility and bulk. Hard rubber valves and plug cocks have a disadvantage in that they usually are made with screw threads. Most acid lines are made up with flanged joints, and if hard rubber valves are to be used, extra fittings are needed. This means extra joints. Outside of this, hard rubber valves are very satisfactory. One type of soft rubber lined valve consists of a metal casing containing a loose soft rubber liner of thin cross section. This liner is compressed to shut off flow. The liner may be easily replaced when it fails.

Processing—Under processing may be considered such operations as pickling, precipitation, neutralization, or acid addition. These may be carried out using hot or cold acid, most reactions, however, involving some temperature. In these reactions the acid is used in a more or less diluted condition. There may be used for this purpose wood tanks, enameled steel, stoneware and hard rubber lined tanks. For acid below 150 deg. F. we may include soft rubber lined tanks.

Enameled tanks and stoneware tanks may be jacketed. Stoneware tanks are usually set in oil jackets containing steam coils. Installations have been made using rounded stone tanks set in steel jackets and using waste steam as the heating medium. This is dangerous practice for these kettles will crack if extreme care is not used to heat slowly and uniformly. There is the disadvantage also of low coefficient of heat transfer. When using oil jackets, allowance must be made for oil expansion which in some cases is quite large. Another method of heating the contents of stoneware kettles is by means of injected steam. This also is dangerous as the hammering and vibration caused by the injection system is liable to cause cracking unless carefully controlled.

One manner of protecting stoneware against such breakage is to insert the kettle in a wooden or steel casing with several inches of high melting tar between the kettle and casing. If the kettle should crack the contents will not be lost nor the casing destroyed. Stoneware apparatus is most resistant, but its fragility militates against its wider usage.

TANKS of vitrified tile or brick have been used for handling hot HCl. The contents of these tanks are heated by means of injected steam. Care must be taken to have the steam inlet at some distance from the bottom and sides. There is a tendency for the hammering and vibration set up by the steam coming into contact with the cold liquid to cause the joints to crack or open. A backing of high melting tar or pitch between the tile and support is necessary. This will tend to absorb vibration.

Enameled jacketed kettles do not have the disadvantage of stoneware. They may be operated under a maximum steam pressure of 75 pounds per square inch. They have a much higher coefficient of heat transfer. There is a tendency for the lining to wear, especially if there is a stirring device and solid material present during the processing. Aside from a fairly high first cost, these kettles are very satisfactory. For small batch work they are probably the best.

For large batch work wooden and hard rubber lined steel tanks have proven satisfactory. In one installation

quarter sawed cypress tanks of 2,000 gallons capacity have been handling HCl of specific gravity 1.150 (75 per cent HCl) at a temperature of 100 deg. C. These tanks have been in service over two years handling two batches per week. The acid is heated by injected superheated steam (450 deg. F. at superheater). A 1,000 gallon steel tank hard rubber covered is also being used under similar conditions, the acid being heated in the same manner. This tank has also been in service about two years and is still being used. Each batch run requires a boiling period of over three hours.

Soft rubber linings cannot be used with hot HCl. The lining swells in a peculiar manner, under extreme cases resembling rubber sponge.

For cooler HCl one may use any of the materials previously mentioned and, in addition, soft rubber. One unique application has been that of a soft rubber lined ball mill in which sharp edged brass pieces are treated with concentrated cold HCl to remove soft solder. These pieces are tumbled for a short period in the concentrated acid. An automatic vent is provided to allow the evolved hydrogen to escape. While this apparatus has been in use nearly two years, no wear can be detected.

In the preceding the writer has described various constructional materials with the thought of preventing any contamination of the acid, and avoiding the constant maintenance due to corrosion and wear. There are on the market a few alloys which are resistant to HCl, such as the ferro-silicons, and copper-manganese alloys. These alloys have a fairly long life when in constant service, so that air is for the most part, excluded. The fact remains, however, that they corrode, necessitating replacements, and introducing substances into the acid which may have a harmful influence on the resulting product. Where contamination cannot be permitted the methods outlined above will prove acceptable.

A New Permissible Explosive

Adding hydrated magnesium nitrate to ammonium nitrate solves difficult drying problem

By B. I. Stoops

Experimental Station, Hercules Powder Company, Kenvil, New Jersey

ONE of the problems in blasting coal has been reduction of the shattering effect on coal due to the rather concentrated mass of explosive at the bottom of the hole. The first attempt to overcome this was by the use of lighter pulp in the dynamite, making a less dense cartridge, which would be in contact with a greater length of borehole. Even sugar cane, dried and shredded, was used for this purpose as a substitute for wood pulp. Naturally a limit was finally reached, and the industry began to use the so-called cushioned blasting, which involved an air space in the borehole. This air space absorbed the first shock of explosion and distributed a more nearly even pressure over a greater area of coal.

Wood pulp, soaked in a solution of ammonium nitrate and then dried, forms a very light, bulky ingredient for permissible powders, which reduces the density of such explosives more than the means mentioned above (U. S. Patent No. 1,444,594). For example, before the development of low density dynamites two hundred and seventy 1¼-in. x 8-in. cartridges per 100 lb. was the general rule. By the use of low density pulps or baggasse, this could be raised to about 370 cartridges per 100 lb. This number of cartridges can be increased to about 500 per 100 lb. of explosives if even lighter carbonaceous materials are used, e.g., sawdust from the lightest known wood, balsa. To accomplish this result, however, 16 per cent or more of such sawdust is required. This amount has too much absorbent power; the nitroglycerin is too well absorbed. The surface film of nitroglycerin disappears and the dynamite becomes insufficiently sensitive to a blasting cap to detonate properly or at all. To avoid this difficulty balsa sawdust may be soaked in a solution of ammonium nitrate and then dried. The crystals of ammonium nitrate in the pores of the sawdust then prevent undue absorption of the nitroglycerin present and an effective dynamite containing up to 500 or more 1¼-in. x 8-in. cartridges per 100 lb. is obtained.

But a serious disadvantage of carbonaceous materials impregnated with ammonium nitrate is the difficulty and danger of drying. Ammonium nitrate retains water tenaciously at rather high temperatures, and long periods of drying are necessary to dry a moist mixture of ammonium nitrate and wood pulp. The risk of fire during such drying is serious. The dynamites made in this way are satisfactory as to explosive characteristics, but the risk of manufacture is too great to warrant their adoption.

A recently developed method of avoiding these difficulties consists of mixing with the ammonium nitrate a few per cent of hydrated magnesium nitrate (U. S. Pats. 1,671,792 and 1,671,793). Hydrated magnesium nitrate melts in its water of crystallization at 198 deg. F. After mixing in the proportions of 20 per cent of hydrated magnesium nitrate and 80 per cent of ammonium nitrate the mixture melts in its water of crystallization at 230-240 deg. F. When thus melted it can be incorporated with balsa sawdust and will impregnate the latter thoroughly. Upon cooling the water present reverts again to the form of water of crystallization and the mixture is then to all intents and purposes physically dry. Thus the dangerous and expensive operation of drying mentioned above is completely avoided. When later the supply of balsa wood sawdust was found inadequate, pith from the interior of sugar cane was used with equal or superior results.

A dynamite composed of 12 per cent nitroglycerin, 71 per cent of the impregnated balsa wood or pith, 5 per cent ammonium nitrate and 12 per cent sodium nitrate has passed the Bureau of Mines tests for permissibility and is permissible for use in gaseous and dusty mines. One 1⅜-in. x 8-in. cartridges only weigh 110 grams, and gives 827 liters of gas on explosion. The calculated temperature of explosion is 1,800 deg. C. A cartridge of black powder pellets 1⅜ in. x 8 in. weighs 292 grams and gives about 900 liters of gas on explosion, at a calculated temperature of 2,200 deg. C.

Black powder is only safe in mines which are free from gas and dust. This light permissible dynamite, on the other hand, is not as easily ignited by sparks as black powder and is therefore much safer to handle. It can be substituted cartridge for cartridge against pellet black powder with practically equal execution, due to the effectiveness of the cushioned-blasting attained.

Liquid Phase Cracking Processes Show Modern Developments

By Ernest Owen
E. B. Badger and Sons Company, Boston, Mass.

LIQUID phase cracking processes are the only ones that have been developed extensively to date and are a factor of real commercial importance in the production of gasoline. The processes of this type that have attained the most prominence at the present time are the Cross, Dubbs, Tank-and-Tube, Holmes-Manley, Isom and the Jenkins. Before taking these processes up in detail, it might be well at this point to consider the basic principles of liquid phase cracking which will serve as a foundation on which the engineering superstructure may be safely built. We can then determine the avenues open for improvement in cracking technique and how far the application of these principles have been realized in the processes in existence today.

The following statement of the principles of cracking is based mainly on the work of Dr. Eugene H. Leslie, who has done extensive research work leading toward establishing these principles ("Motor Fuels," New York, 1923, and "The Cracking of Petroleum Oils" by E. H. Leslie & E. H. Potthoff, *Ind. & Eng. Chemistry*, August, 1926):

(1) The rate of cracking of gas oil and heavy fuel oil is slow at 700 deg. F., but at 800 deg. F., it is rapid. The approximate rule that the rate of a chemical reaction doubles for every 10 deg. C. or 18 deg. F. rise in temperature holds fairly well. The data indicate a doubling for every 12 deg. C. or 22 deg. F. when gasoline is formed from gas oil or heavy fuel oil.

(2) Thermolized or recycle gas oil cracks at 800 deg. F. to form lower boiling substances, but at a rate only half that which fuel oil cracks and materially lower than that at which gas oil decomposes.

(3) Cracking is a function of the time of reaction. Since there is a very considerable time interval between the attainment of cracking temperature and the setting in of appreciable decomposition, it is possible to segregate the formation of carbon into a part of the apparatus where the carbon can be conveniently handled. The velocity through the tubes should be sufficiently high in order to allow the removal of the oil from the heating zone to the segregating zone before much cracking has taken place. The temperature differential between the oil in the tubes and the heating means should be as low as possible, consistent with economical operation, since the oil at the surface of the tube may become overheated, resulting in the deposition of carbon on the surface of the tube.

(4) Cracking is endothermic to the extent of not more than 500 calories per gram of gasoline produced.

(5 Removal of gasoline as formed has no effect either on the yield or boiling range of the gasoline produced.

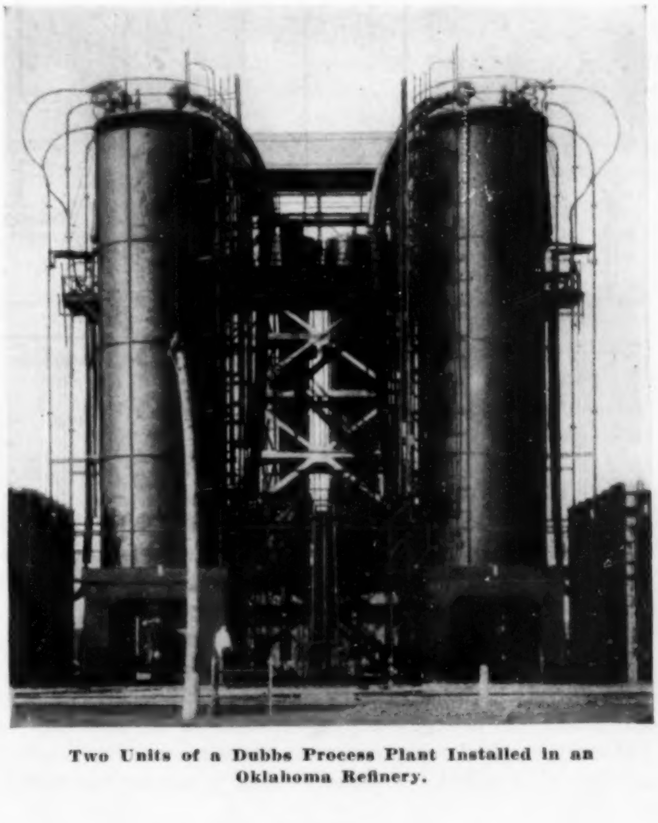
(6) Unsaturation of gasoline is effected by pressure only when pressure indirectly affects the time the gasoline stays in the reaction zone. Unsaturation decreases with time of heating.

(7) Pressure as such has no influence on the boiling range or distribution of compounds in the gasoline produced when operating under different pressures.

(8) Leslie states that pressure has no effect on the yield of gasoline, although it influences the rate of vaporization, and thus the heat flow rate and the temperature of the superheated films. Other investigators maintain that pressure causes molecular scission to be directed toward the middle of the molecule instead of the end of the chain, resulting in the formation of less coke and non-condensable gas as the pressure increases.

(9) Leslie claims that cracking, contrary to common belief, is not a process in which an equilibrium state is reached. The apparent state of equilibrium reached in a cracking system, using an insulated reaction chamber is the result of decreased reaction rate caused by the lowered temperature resulting from heat loss and the endothermic cracking reaction. Apparently if the reaction is to be maintained, sufficient heat should be supplied to the oil in the reaction chamber to make up for the heat of crack, vaporization and radiation.

At this point it might be well to call attention to the confusion existing in the petroleum industry at the present time regarding the method of rating the capacity of cracking units and in computing the yields of gasoline from a given charging stock. It is desirable that a uniform method shall be used in establishing the capacity of cracking units, and this should be based either on the total amount of oil (e. g. gas oil) charged to the system



Two Units of a Dubbs Process Plant Installed in an Oklahoma Refinery.

per 24 hours, assuming the charge to be uncracked oil, or the daily gasoline production may be used as a basis in rating the unit. The former method has been used in this article. The percentage yields of gasoline should be based on the same throughput and should not include the increased yields obtainable by subsequent cracking of the bottoms from the pressure distillate or the tops from the residuum. This is also a more rational method than basing the yield of gasoline on the oil consumed, as is frequently done.

As THE BURTON process was developed by an organization accustomed to using shell stills, and pipe still distilling units were as yet in their infancy, it is natural that the first cracking stills should be of a horizontal cylindrical type. Difficulties, however, were experienced with carbon deposits on the heating surface, which not only resulted in short operating cycles but constituted a serious fire hazard. In addition the unit had poor heat economy and low throughput capacity.

With an idea of overcoming these difficulties, the design of the still was modified and made very similar to the Heine type of water-tube boiler. These latterly called Burton-Clark units consist of a horizontal steel shell, 10 ft. in diameter, and 30 ft. long, having suspended from front and rear headers a bank of 4 in. tubes. These tubes are exposed to the hot furnace gases while the shell itself is protected. The slope of the tube bank is such that circulation is by the thermo-siphon principle, the rapid movement of the oil through the tubes carrying the suspended carbon out of the heating zone and depositing it in the unheated distilling chamber. The vapors under a pressure varying from 75 to 100 lb. from the still pass through an aerial radiator type reflux condensor to a heat exchanger and water cooled pipe condenser coil and thence to a receiving drum in the "tail" house. The entire cycle, including the time to charge, fire, cool and clean, varies between 48 and 72 hr.

The stills are operated on the batch-and-feed principle, the oil being heated to a temperature of about 790 deg.F. The initial charge is 250 to 325 bbl. and when running an additional charge varying from 100 to 200 bbl. is fed in through the vapor line to make up for the portion of the oil distilled. A point is finally reached at which the deposition of carbon requires shutting down and cleaning. When charging Mid-Continent gas oil, a final yield of 25 to 33 per cent of gasoline based on the throughput is obtained by rerunning the pressure distillate produced.

Burton and similar types of cracking units are practically limited to distillates of low coke forming characteristics, such as gas oil. It was not until about five or six years ago, however, that cracking of heavier oils became of economic importance, when the price differential between fuel oil and other stocks acted as an incentive for development work along these lines. For several years the Standard Oil Company of Indiana was able to limit the use of other liquid phase processes, claiming a basic patent on the cracking of oil. The situation remained unchanged until about 1918 when the Cosden Company, after a careful consideration of the patent situation, decided to install a number of Coast units.

The Coast process is similar to the original Burton, except that the pressure is released before the vapors reach the condenser, instead of after condensation as in the Burton. Approximately the same temperature, pressures and length of cycle are maintained in both systems, although a greater yield of gasoline is claimed for the Coast process than for the Burton. The still itself is 8 ft. in diameter by 40 ft. long, and provision is made for keeping the fire sheet free of carbon by a means of a rocker arm arrangement which drags a series of chains across the bottom of the still, thus keeping the carbon in suspension.

About 1920, the Fleming process was developed at the Martinez refinery of the Shell Company of California and later the sale of these units was taken over by the M. W. Kellogg Company. Contrary to the usual practice, Fleming placed the still on end, the reason being that the heating surface is increased by heating the entire circumference of the still and also that carbon has less tendency to deposit on vertical surfaces. Since the bottom of the still is not heated, no particular harm can result from an accumulation of coke at this point. This still itself is a 10 ft. by 30 ft. steel drum, heated by four burners which are set tangentially to the shell at the bottom to give the products of combustion a swirling motion around the shell. From the top of the still, the vapors pass to a dephlegmator. Here the feed oil on its way to the still meets the hot vapors, condensing the heavier fractions and carrying them back into the lower part of the still.

The overhead vapors that leave the dephlegmator are condensed in an apparatus of the jet type. The pressure on the system, varying from 110 to 120 lb., is relieved by the needle valve in combination with the jet condensor to approximately atmospheric pressure. The com-

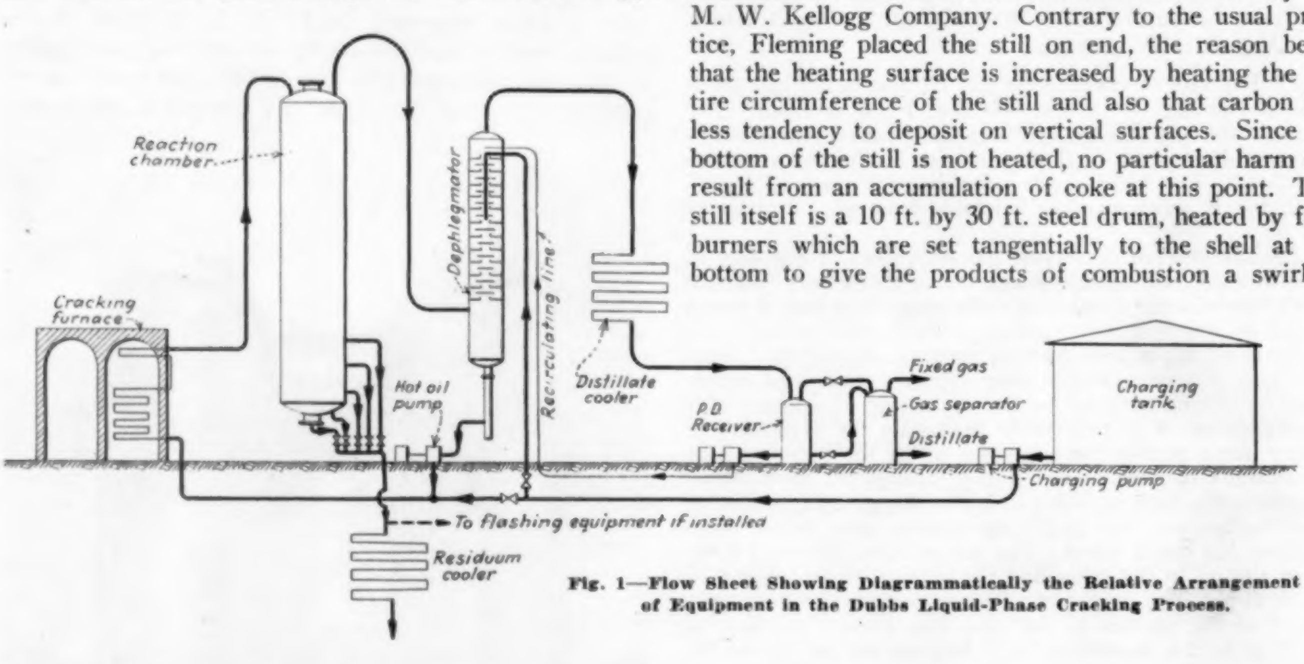


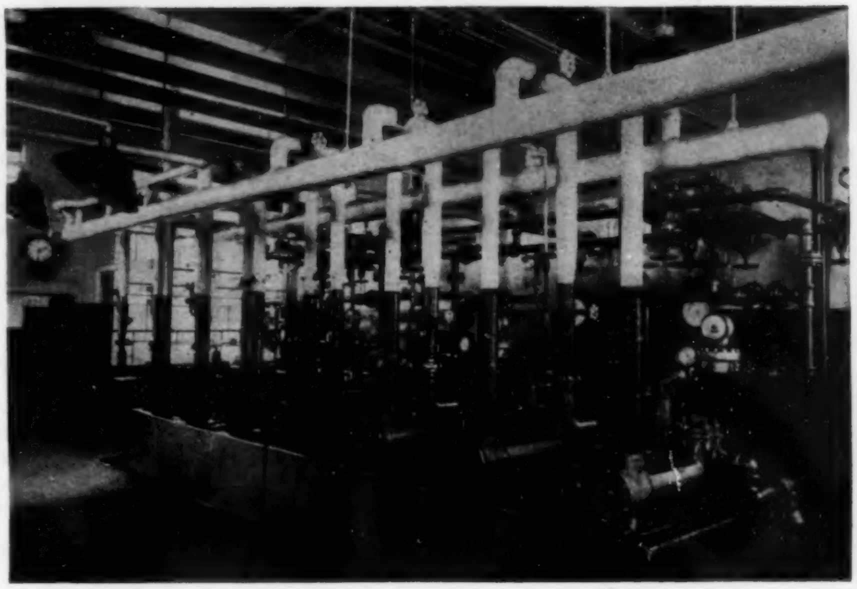
Fig. 1—Flow Sheet Showing Diagrammatically the Relative Arrangement of Equipment in the Dubbs Liquid-Phase Cracking Process.

bined water and condensate is discharged into a separating tank where the water is drawn off and the fixed gases removed to be used as fuel.

The cycle varies with the character of the stock charged. The still is on stream from 40 to 60 hrs., the time being determined by the carbon deposition. To relieve pressure, steam, cool and clean requires 24 hrs., making a total cycle of 64 to 84 hrs. For average conditions of operation, the apparatus is rated at 70 bbl. of gasoline per unit per day from 200 bbl. of gas oil or charging stock, giving a gasoline yield of 35 per cent. The fuel consumption averages about 8 per cent of the throughput.

Those liquid phase cracking processes that have just been discussed are now being rapidly replaced by other processes, such as the Cross, Dubbs, Holmes-Manley, and the Tank-and-Tube, which operate at greater efficiencies, produce larger yields of gasoline, and have much greater daily capacities. For instance, of the 62 Fleming units installed at 16 refineries, it is understood that all have been shut down with the exception of those at one, or possibly two refineries. Hundreds of Burton stills have also been taken permanently out of operation during the past few years.

The next step in the development of the modern cracking process was the introduction of forced circulation to increase the rate of oil flow through the cracking tubes, resulting in a greater capacity of the unit, and a decrease in the carbon deposits on the heating surface in the furnace.



Pump Room in a Dubbs Cracking Plant

APART from forced circulation, the Jenkins still is very similar to the Burton-Clark still. There are, however, wider differences in the fractionating equipment of the modern Jenkins unit. Jenkins units moreover have a wider flexibility as regards choice of charging stock, and are being operated on crude oil, gas oil, and residuum. This process is owned by the Jenkins Petroleum Process Company, and the Graver Corporation acts as sales representatives and builders. About fifty of these units are in operation and under construction at the present time. The new units have a throughput capacity of about 1700 bbl. of gas oil per day and operate on a cycle varying from a week to two months, depending on the character of the charging stock and the products desired.

The arrangement of the fractionating equipment to be described here is one of several types which are used. Others involve the use of heat exchangers, the elimination of the reboiler, the incorporation of the expander section in the bubble tower, and other modifications. A typical unit comprises: (a) Cracking still. (b) Overhead equipment, comprising a reflux tower, bubble tower with integral reboiler, gasoline condenser and cooler, and a cooler for the reboiler bottoms. (c) Residuum equipment, comprising an expander, fuel oil settling tank and a cooler for the gas oil overhead from the expander. The operating pressures carried on the unit vary from 125 to 200 lb. per sq.in. depending principally on the character of the charging stock.

The charging stock enters the unit through the top of the reflux tower, which is 5 ft. in diameter by 35 ft. high, equipped with interior flat baffle plates. Flowing downward it contacts with the vapor from the cracking still. The charge plus the reflux condensed out of the heavy ends of the vapor, is then introduced into the still. The still proper consists of a main drum 6 ft. in diameter by 39 ft. long. Underneath the shell and near both ends are legs connected to cross drums. The front leg is shorter than the rear leg so that the tubes (140 of $3\frac{1}{2}$ in. O.D. seamless steel) which connect the two cross drums slope from the front to the rear. A motor driven impeller is operated in the rear leg to produce a rapid circulation of the oil through the tubes. Provision is made in the still setting for an air preheater and flue gas recirculation of the Lientz type, which increases combustion efficiency.

The cracked vapors, stripped of their heavy ends in the reflux tower, pass to a bubble tower (6 ft. in diameter), the pressure being reduced very materially between these two towers by means of a reducing valve. A gasoline cut is taken overhead from the top of the bubble tower, while recycle gas oil is drawn from the bottom of the tower through a reboiler. The light ends are thus stripped out by the heat contained in the vapors from the expansion chamber. When it is desirable to separate the gasoline overhead, a secondary bubble tower is installed. In this second tower a high gravity gasoline stream is taken overhead while the reflux from the base of the tower goes to a rerun still. Closed spiral "trim" coils are provided at the top of both the reflux and bubble towers for the maintenance of proper control of operating temperatures.

A predetermined amount of charging stock is drawn off continuously from the front cross drum of the cracking still and flashed in an expansion chamber. The light ends from this chamber, which are of the nature of gas oil, pass through the reboiler mentioned above, to a cooler. The residuum from the expander, which contains a small amount of coke, flows to a fuel oil settling tank, which is usually a vertical tank, equipped in the bottom with a quick opening valve for the removal of sludge, where the carbon is deposited, and thence to storage.

Typical yields obtained from 32.9 deg. Bé. Mid-Continent gas oil in a Jenkins cracking unit are given below:

	Based on Throughput, in Per Cent	Ultimate Yield by Recracking, Per Cent
Gasoline	32.9	67.7
Recycle stock	51.4	.....
Fuel oil	13.0	26.8
Liquid loss	2.7	5.5
	100.0	100.0

In most of the Jenkins units, a small amount of lime is introduced with the charging stock. This practice is also followed in some installations of other cracking processes. It is claimed that lime reduces the formation of carbon, tends to lessen the treating problem for finished distillates, causes polymerization of some of the compounds responsible for the formation of the gums in gasoline and reduces the corrosive action of sulphur and other compounds in the still and towers.

INVENTED by Dr. E. W. Isom, vice-president of the Sinclair Refining Company, all installations of the Isom process have been made at refineries owned by the Sinclair organization. This process consists in the continuous cycling of the oil through a bank of vertical heating tubes to and from an overhead vaporizer chamber. Suction is taken on the bottom of this chamber, which is a horizontal insulated cylindrical steel shell, 9 ft. in diameter by 31 ft. long, by a hot oil circulating pump, which discharges the oil through fifty 4 in. tubes 20 ft. long, fitted with Foster superheater elements exposed to the furnace gases. The oil from these heating elements then re-enters the vaporizer chamber in the center of which is a horizontal bed of fuller's earth about 8 in. thick supported on a screen. A part of the oil together with the tar separated out by the fuller's earth is continuously withdrawn from the middle of the chamber. It is claimed that the use of fuller's earth has lengthened the operating cycle from 2 days to as long as 20 days.

Cracked distillate from the vaporizer passes through a 5-ft. diameter by 28 ft. high reflux tower and then to a water cooled condenser. Condensation takes place under reduced pressure. The system is charged continuously during the cycle by pumping the raw oil into the top of the reflux tower. The Isom carries approximately the same cracking temperatures but slightly higher operating pressures than are used in the Burton process.

The throughput capacity of the unit is 1,200 bbl. of gas oil per day, and the yield of gasoline obtained by rerunning the distillate averages 31 per cent of the total feed.

Figure 1 shows in diagrammatic form the relative arrangement of the equipment comprising the Dubbs process and the flow of oil and vapors through it. The Dubbs units are built in standard sizes having capacities of 700, 1,000, 1,500, 3,000 and more bbl. of fresh charging stock per day. The process is owned by the Universal Oil Products Company of Chicago and many installations have been made in American and foreign oil refineries.

The apparatus comprising a standard unit consists principally of the following equipment:

(a) Furnace composed of two compartments, one of which is a combustion chamber, while the other compartment contains the heating tubes around which the products of combustion pass counter current to the flow of the oil. The heating surface in a 1,000 bbl. Dubbs unit consists of sixty-two 4 in. diameter tubes each 30 ft. long, and in a 1,500 bbl. unit of seventy-eight 5 in. diameter tubes each 30 ft. long arranged with return bends to form a continuous coil.

(b) A heavily insulated reaction chamber, which is electrically welded or of seamless steel construction. The number and size of these chambers will vary with the capacity of the unit, the character of the charging stock and the amount of coke formed during the cracking operation. In the older 500-bbl. units a single 10 ft. x 10 ft. shell was used, in the larger size modern units one or two 10-ft. diameter by 40 ft. high chambers are installed.

(c) A dephlegmator of the perforated pan type is used to fractionate the heavier vapors from the lighter cracked vapor product issuing from the reaction chamber. The return of the reflux, or condensed heavy vapors, to the cracking coil is accomplished by means of a hot oil pump. The light fractionated pressure distillate vapors pass upward and out at the top of the dephlegmator.

(d) A pressure distillate water cooled condenser.

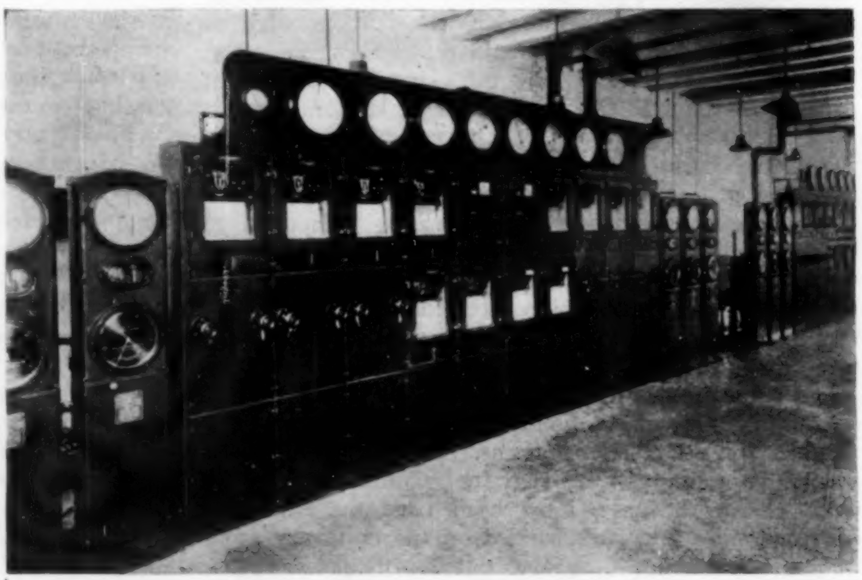
(e) A pressure distillate receiver and a gas separating tank.

(f) A residium water cooler.

(g) Control house containing the filling, feed and recirculation pumps, the temperature recording instruments and important control valves.

OPERATION of the process is as follows: The raw charging stock is pumped either to the dephlegmator or direct to the heating tubes, or may be diverted in part to the dephlegmator and part to the heating tubes as control conditions require. The raw oil and reflux from the dephlegmator pass through the continuous heating coil wherein the oil is raised to a temperature of approximately 860 deg. F., and then flows into the top of the reaction chamber.

The reaction chamber is not an externally heated vessel and serves the purpose of holding the accumulation of carbon or coke which is formed by cracking during many days or weeks of continuous operation. When the production of residual fuel oil is desired the control valve at the bottom of the reaction chamber permits the residual oil to be withdrawn continuously to a



Instrument Board in the Control Room of a Large Cracking Plant

flash chamber, or when desired, the residual oil may be sent direct to a cooling coil and to storage.

VAPORS which arise from the hot oil within the reaction chamber pass to the bottom of the dephlegmator wherein the heavier portion of the vapor is condensed while its heat is interchanged into the incoming raw charging stock, pumped into the dephlegmator. The mixture of raw charging stock and reflux condensate oil at a temperature of about 750 deg. F. passes downward to the suction side of the hot oil pump, and it is then discharged into the heating coil. The light vapors pass from the dephlegmator to a water cooled condenser. The condensate and fixed gases flow to a pressure distillate receiver drum, where the high pressure gas release control valve maintains the proper cracking pressure upon the system.

In the event that flashed residual fuel oil is desired, the oil is withdrawn from the reaction chamber at process pressure, and flashed through a pressure reducing valve into a vertically arranged chamber of a size suitable for the capacity of the plant. The vapors from flashing may be mixed with the incoming cracking stock where the cracking stock is the condensing medium within an open or perforated pan type tower. The bottoms after flashing are then sent to the residuum cooler and then to storage.

The entire plant including the heating coil, reaction chamber, dephlegmator and condenser is under a uniform pressure which is controlled by the discharge of the gas from the receiver drum through a pressure control valve. The pressure carried on the unit varies with the character of oil under treatment, averaging about 200 lb. gage, more or less as conditions require.

It is claimed that in this system any charging stock may be cracked, from heavy residues of low gravity to light gas oils as kerosene, and without change in the apparatus but merely by modifying certain control conditions. The cracking of kerosene is considered to be uneconomic, however, due to its demand and greater market value as compared to the availability and lower price of gas oil, fuel oil, topped crude or low grade crude.

It is also possible so to control the mode of operation as to produce a large percentage of cracked residual fuel oil, a relatively small percentage of cracked fuel oil or, no fuel oil whatever with what is termed the "non-residuum" type of operation. This permits three general classifications of the modes of operation and the products from cracking may be listed as follows:

(a) Pressure distillate (gasoline and gas oil) coke and fuel oil wherein the fuel oil passes all market specification.
(b) Pressure distillate (gasoline and gas oil) and coke.
(c) Gasoline, gas oil and fuel oil. This mode of operation is primarily to lower the viscosity and to lower the cold test of heavy oils whereby the gasoline produced is a substantial byproduct.

In reviewing the results from a large number of runs, it is evident that the yield of gasoline and formation of coke varies over wide limits depending upon the character of the charging stock and the method of operation. Results from typical charging stocks are given below when cracking with a single passage of oil through the process or, with what is termed "one throughput."

The length of the run is dependent chiefly upon the size of the reaction chamber or chambers, the coke forming property and carbon content of the charging stock and the cracking operation selected. The period of continuous operation varies from four days to over thirty days.

Table I. Results Obtained by Dubbs Process With One Throughput of Typical Charging Stocks

	Gravity A.P.I.	Per Cent Navy End Point Gasoline	Lb. Coke per Bbl. Raw Oil	
California Residuum	17.8	35.8	5.63	(residuum)
California Gas Oil	25.6	49.75	0.088	(residuum)
Smackover Fuel Oil	18.5	50.0	55.0	(residuum)
Mid-Continent Fuel Oil	24.5	50.9	66.0	(non-residuum)
Mid-Continent Fuel Oil	25.0	58.7	55.6	(non-residuum)
Mid-Continent Fuel Oil	26.5	45.0	1.3	(residuum)
Mid-Continent Topped Crude	29.7	64.0	48.9	(non-residuum)
Mid-Continent Gas Oil	30.0	53.6	0.11	(residuum)
Mid-Continent Gas Oil	32.6	55.6	0.05	(residuum)
Pennsylvania Gas Oil	38.8	72.0	25.0	(non-residuum

EDITOR'S NOTE: *The Cross, Holmes-Manley and Tube-and-Tank processes will be discussed in a subsequent article by Mr. Owen.*

Combustion Discussed at Swampscott

COMBUSTION is probably, without exaggeration, the most important chemical reaction to the human race. Not only is combustion our major source of industrial energy and power, but also the fundamental reaction supporting life. In a joint symposium recently held by the Gas and Fuel and Petroleum Divisions of the American Chemical Society practically all phases of technical or industrial combustion were discussed except the combustion of solids.

The symposium was under the chairmanship of Professor George Granger Brown of the chemical engineering department at the University of Michigan. Three papers were presented by outstanding English investigators in this field in addition to seventeen papers by American contributors. Most of the papers were received in time for preprinting so that all those in attendance could better follow the speakers and the discussion. Numerous interesting orthochromatic photographs of peculiar bunsen flames were exhibited by Smith and Pickering of the Bureau of Standards. Dr. W. Payman of the Safety and Mines Research Board of England was present and contributed greatly to the discussion of flame propagation as well as presenting an outstanding paper on the interrelation of the different variables on the normal propagation of flames in gaseous mixtures.

Campbell, Lovell and Boyd of the Research Laboratory, General Motors, Inc., presented a paper indicating that all knock rating tests should be conducted with that particular mixture ratio giving the worst knock with the fuel tested. This thesis brought forth considerable discussion as other laboratories have considered other adjustments as more satisfactory in their work. However, the consensus of opinion seemed to be in support of the authors of the paper.

Much interesting discussion was also developed on the ignition temperature of various fuels and the effect of lead tetraethyl on the ignition temperature. Some investigators maintained that there is no such thing as a true ignition temperature independent of experimental conditions, while others believed that experimental conditions could be so controlled so as to lead to a computation of a true ignition temperature which would be practically free from elements impeding experimental procedure.

What's Wrong with the Plant's Engineering Office?

An attempt to find out why incentive is lacking and progress slow in many large industrial departments

By Laurence Eddy
Ashland, Kentucky

A FEW YEARS AGO I derived much pleasure from *Chem. & Met.'s* series of sketches on industrial plant departments and their functioning, but I do not remember reading anything on the engineering department of the average industrial plant. The fact that this branch of activity is not important enough to warrant consideration, even by technical men themselves, has been a source of concern to those of us who earn our bread and butter in these forgotten places. Therefore I should like to present a close-up of that department, as seen from within. Perhaps I can show why the plant engineer leads a lowly life and demonstrate whether or not a more important rôle would benefit either industry or the profession.

It is remarkable how alike these plant offices are, from the Old Man in his partitioned-off seclusion, right on down to the filing cases and the cock roaches that scamper in and out of them. One can, therefore, generalize with more than usual safety.

The typical large corporation plant engineering office is a product of evolution. Like embryonic legs still found on some species of whales, although whales haven't walked on land for a million years, the office retains some forms and customs that are not altogether in keeping with the present state of affairs. In the dim beginning, when the Proprietor just started to delegate his activities to the hired help, he let go of the most onerous jobs first. He took on a bookkeeper, and now we have the accounting department, with rows of girls and tabulating machines. The Boss was irked by peddlers; now we have a full-fledged purchasing department. But when it came to engineering, i.e., planning, that was fun, and besides, the owner had a sneaking idea that the business was prospering because of his own superior planning ability. So he hung on to the planning of extensions and alterations.

AFTER a while though as the plant grew the owner was unable to cover all of the ground, and so his knowledge of intimate details gradually became limited to one or two branches of the business, perhaps sales and finance. He had to rely on his superintendents in the factory, more and more. And then these "practical" Men of Vision—who were the life of the business—formed a little group to plan and engineer. Well, after they they had decided what plant extension was to be made they called in a building contractor and gave him their plans, sketches on backs of envelopes maybe, and set him to work executing their ideas. This was stage number one.

But most plant construction is special. The contractor didn't comprehend it all. Things didn't tie together so well. So the Men of Vision decided to work their plans in more detail, directly under their own supervision. A draftsman was employed. Maybe an ambitious youth working elsewhere in the day time came in to do part-time work in the evenings. All that was required was a neat workman. That was the second stage.

A good many plants—large ones too—are still in the second stage. One or two bright youngsters, who can make up detail drawings, run a surveyor's level, and measure broken castings do the job. The real planning is still done by the Men of Vision, aided when necessary by specialists from outside the organization. Most of this advice is normally gratis, received from sales engineers employed by the equipment manufacturers.

TIMES usually come, however, when some major plant expansion is deemed imperative. The home-grown draftsman has never handled such a big job. He isn't heavy enough to inspire confidence so an engineering department is organized, to carry out the program—once the Men of Vision have thought it out in general and also in considerable detail. This then is still the fundamental status of the present-day engineering department in most plants. It has its tasks set before it, already conceived and fairly well thought out. Its function is to carry out the ideas of the Men of Vision. It is their tool.

Once organized the engineering department is usually a fixture. The construction program is never quite finished. Other improvements come along. In a few instances the department may be retained as a matter of "keeping up with the Joneses." Competitors maintain such appendages; if we don't, the trade may think we are not progressive. Then too, the engineering department is a convenience in many ways. The busy plant manager receives in his mail many suggestions, complaints, and advertisements. Those not interesting enough to be given his personal attention are re-directed to the engineering department with his initialed comments "?," "looks good," "please check." Thus the engineering department becomes the final recipient of literature on patent lubricants, paints that last forever, and samples of quick-setting cement that sets before you can pour it. The plant manager is in the clear. It can't be said that

he overlooks these modern improvements. Not at all. He has "referred them to the engineering department."

Note, however, that the engineering problems in connection with the plant's manufactured product, such as customers' complaints, improvements in product, or development of new articles, are not referred to the engineering department at all. They go to another specialized tool of the Men of Vision—the research department. The engineering department as now constituted in our large companies is only concerned with plant expansion, and maintenance, and sometimes the development of special machinery especially where secrecy is to be maintained. There is a growing tendency to have outside specialists develop special mechanical devices, and to discount the value of secret processes.

So this is the engineering department. Well, what of it? In the first place its personnel must suit its functions. The chief has his work cut out for him (by others) and must be willing to take his assignments with whatever comments or explanations the Men of Vision choose to release. He must not ask too many questions. In the execution of the work, he must be carefully conscious of the limitations of his own authority, and to obtain approval of any details beyond his jurisdiction. Most plants have engineering and construction standards formally worked out and adopted, covering in some cases the most minute details of construction. The chief finds a surprisingly large part of his time taken up in seeing that work is done to conform to these visible standards as well as to those invisible standards repeated by the personal whims of the people who will later operate the completed plant. A knowledge of these plant standards and whims is more necessary to him than a knowledge of the particular business he is in. A chief engineer could be transplanted from a heavy chemical plant to a steel plant and find himself not greatly embarrassed by lack of detail knowledge of the latter business. He would, however, "stub his toe" over this superintendent's prejudice against Blank Company's cranes, or that one's notions about some particular brand of coupling. Operating superintendents don't change jobs very often, so their pet hobbies are deep rooted. Their knowledge is "practical," and they bristle with antagonism against "theoretical" arguments the engineer may put forth. So the chief sometimes finds it the easier path to humor the whims of his associates even knowing that in other plants the equipment in question is being used successfully.

Here is a close-up from one on the inside. It is based on experience gained while employed in the engineering departments of a representative group of large corporations in chemical engineering industries. Check it with your own observations. Perhaps you have a different answer for Mr. Eddy's question.

IN LARGE offices the chief has some assistants: almost always an electrical engineer; usually an "assistant chief engineer," whose principal function is that of correspondent; sometimes special assistants, such as a steam and power engineer or a lubrication engineer. Of course, these specialists are not part of the engineering office in organizations where it is the policy to break up the technical work into small, easily controlled groups. Then there is a "chief draftsman" who routes jobs through the drafting office. The actual work of the office is done by key men working on drafting boards. Sometimes on large jobs a "squad boss" does the principal design at the same time directing a few junior draftsmen working on the details. The drawings are usually "checked" by a checker for detail correctness. The lowest of the low are the tracers—boys who transcribe the pencil drawings onto the transparent cloth with ink. (Lately modern practice is eliminating a good deal of their work.)

Of the working force, usually half are graduates of engineering schools, and the other half are high-school or grade-school men who have started in as tracers and worked up via the correspondence school and practice. A few, older men, have been skilled mechanics who have taken up drafting as a means of bettering themselves. Always a fair number of foreigners there are too, forever befuddled with their first angle projections.

Since the chief must take his assignments as they come to him, so must the rank and file also fall in line. The man who asks "why" and "wherefore" about the work is a thorn in his superior's flesh, harassed as the chief is by completion dates to be met and estimates that can't be exceeded. So also is the bright boy with the idea of his own, who has a better way of doing the thing. There are so many ways of doing a job, all within debating distance of the perfect solution. So to keep the job moving the Inquiring Mind is squelched, either tactfully and at length, or peremptorily, according to the amount of patience the chief happens to have at the moment. The result is the same either way. The Inquiring Mind is surely eliminated from the force. He either quits, or he sticks. In the latter case a few years transforms him into a perfectly disciplined "yes" man.

So it happens that the plant engineering office is not a very fertile breeding ground for greatness. As a rule, it cannot even produce its own chief, who is usually imported from some construction or engineering firm. There is a vicious circle, wherein little is expected of the department, so that talent is stifled or driven out, and then, since the department contains little talent, less is expected of it. Thus there is a growing tendency to retain outside engineering firms to take care of major construction programs, leaving only minor projects and maintenance to the plant engineering department.

In these days of sharp competition, waste must be eliminated in order to stay in business. Much has been accomplished toward reducing material waste. But human waste—waste of talent—is just as much of an economic loss as steel allowed to rust away for lack of paint. The periodic "house cleaning" to which the vicious circle inevitably leads, is a very ineffective remedy. The dry rot may be eliminated, and a new set of hopefuls installed, but the potential talent of the victims has been irrevocably lost to the company and themselves.

Neither does it profit the engineer, recognizing that he is up a blind alley, to quit. He finds he is only qualified to work in a similar place to the one he left, and seldom has sufficient financial resources to see himself through a non-earning period while he gets started in some other occupation.

What about remedies? The writer feels that the successful large corporation of the future will be the one that adopts so liberal a policy toward its plant engineers that they will not only stick to the company, but will "work their heads off." If they work interestedly, their talents will grow by use, instead of atrophy. At present, factory foremen gladly work unheard-of hours at sometimes unpleasant tasks, because they have ahead of them the very tangible reward of a superintendency to which they can reasonably aspire. The plant engineer has no such reward in view. His duties do not develop executive ability. He is not in line for these higher paid executive positions. But he might contribute profitable ideas if properly stimulated to do so. It is not stimulating to be told that he must assign any such patentable ideas, gratis, to the company. It is not stimulating to be kept so overloaded with routine work and unraveling red tape, that he has no energy left for ideas. It is not stimulating to take the nebulous half idea of another, contribute all the necessary thought to evolve it into a practical workable thing, and see all the credit go to the man who contributed only the bare idea.

I do not advocate higher salaries for plant engineers. Thinking engineers know they are, as a whole, well paid for the ordinary work they do. But I do advocate recognition and direct money rewards for proven special service—quick, sure, and on a very much more liberal scale than management now thinks sufficient. This, in principle, is not a new suggestion. It has been made and tried before, but I recommend it be tried specifically in the engineering department, which now seems to suffer from lack of incentive. The results would be a quickening of interest that would automatically add to the caliber of technical men in the company.

From an intimate knowledge of these plant engineering offices, the writer thinks the results of such a policy of liberal special rewards and above all, recognition for special merit would be astonishing.

A Note on the Corrosive Action of Sulphur Monochloride

By Ellery H. Harvey

Chief Chemist, Montgomery Ward & Company, Chicago, Illinois

A QUANTITATIVE study of the corrosion of pure metals by sulphur monochloride, a liquid chemical of importance in the cold vulcanization of rubber and in connection with the manufacture of "mustard gas," appears not to have been made. At least it was not revealed by the compilation of a sulphur monochloride bibliography involving some four hundred literature citations. Twenty years ago Nicolardot [*Compt. rend*, vol. 147, page 1304 (1908)] without specifying the conditions of the test or citing actual figures, states that the alkaline earths, magnesium and thallium, the alkali metals, precious metals, nickel, cobalt, chromium, manganese, tungsten, cadmium and bismuth, resisted alteration completely, while silver, copper and zinc were but slightly attacked; of all the metals only tin, aluminum and mercury were affected. Colonel Dunn, in his report as Chief Inspector of the Bureau for Safe Transportation of Explosives and Other Dangerous Articles (March, 1921, p. 24), cited experiments in which steel strips 0.0625-in. thick were immersed for thirty days in sulphur monochloride contained in glass bottles. He found that 0.8 milligram of steel was removed per square inch at room temperature (60 deg. to 70 deg. F.), and 2.4 milligrams removed at 100 deg. F.

Table I.—Action of Sulphur Monochloride on Certain Pure Metals

Metal	Form	Per Cent Loss In Weight After 52 Weeks	Remarks
Aluminum	Foil	100	Dissolved immediately with great evolution of heat
Antimony	Lump	100	Dissolved immediately with considerable heat
Arsenic	Lump	85.6	....
Bismuth	Lump	2.1	....
Cadmium	Stick	0.4	....
Chromium	Lump	0.0	....
Cobalt	Lump	0.0	....
Copper	Foil	33.5	The scale which quickly forms protects the metal beneath
Lead	Foil	(3)	....
Nickel	Foil	0.14	....
Manganese	Lump	100	Dissolved after several days
Silver	Foil	(4)	....
Tin	Foil	4.0	A brown sticky film protects the metal beneath
Zinc	Stick	5.7	....

(3) Increased in weight 1.3 per cent.
(4) Increased in weight 0.4 per cent.

In the tests about to be described in this note such practical aspects as air, moisture, physical form, abrasion, etc., were absent, but it is believed that the data are definite as far as they go. "Chemically pure" metals in the physical form noted are weighed into individual bottles, covered with an excess of purified sulphur monochloride, and the bottles closed with bunsen valves. After fifty-two weeks at room temperature in diffused light the metal remaining was washed with carbon tetrachloride to remove adhering scale and reagent, dried and weighed. The bottle containing the sample of iron, the metal of most industrial importance, was inadvertently lost.

Whether the reaction of sulphur monochloride with water is in accordance with the older statements appearing in the literature:

$$2S_2Cl_2 + 3H_2O = 4HCl + H_2SO_3 + 3S,$$

or in harmony with the equation of Olin [*J. Am. Chem. Soc.*, vol. 48, page 167 (1926)]:

$$S_2Cl_2 + 2H_2O = 2HCl + H_2S + SO_2,$$

the fact remains that hydrochloric acid is the most potent corrosive agent of the gaseous byproducts in both cases and would cause the sulphur monochloride to have a more rapid action than under the conditions reported in this note.

Transportation of this chemical is made in steel drums and while readily available and cheap the rapid deterioration in service with ultimate failure not only adds considerable cost to the commodity but weakened drums represent a hazard both to the transportation company and its employees. In view of the figures cited it seems rather evident that certain alloys, or plated steel, would overcome much of the trouble experienced.

The following brief bibliography on the corrosive action of sulphur monochloride is of interest:

M. E. Baudrimont: De l'action du chlorure de soufre sur les métaux et sur leurs sulfures.
Compt. rend., vol. 64, page 368 (1867).

Chevrier: Sur quelques proprietes du chlorure de soufre.
Compt. rend., vol. 64, pages 302-4 (1867).

N. Domanicki: Reaction of sulphur chloride with metals.
J. Russ. Phys. Chem. Soc., vol. 48, pages 1724-7 (1916); *J. Chem. Soc.*, vol. 112, part II, page 369.

Dunn: Report of the Chief Inspector of the Bureau for the Safe Transportation of Explosives and Other Dangerous Articles, March, 1921.

P. Nicolardot: Action of sulphur monochloride on metalloids and metals.
Compt. rend., vol. 147, pages 1304-6 (1909).

E. F. Smith and V. Oberholtzer: Uber die Einwirkung verschiedener Gase auf Metallisches moylbdan und metallisches Wolfram.
Z. anorg. Chem., vol. 5, pages 63-8 (1894).

Loss Calculations in Dissolving, Leaching and Extraction

By C. V. Iredell

Westinghouse Lamp Company, Bloomfield, N. J.

LOSSES which occur in unit processes such as dissolving, leaching or extraction comprise principally that portion of the desired constituent which is discarded with the insoluble residue. Generally such processes are chemically controlled and analysis shows the amount of the desired constituent in the waste material. If the waste material is weighed or otherwise measured, calculation of the losses is, of course, an extremely simple matter, and needs no further discussion. However, there are many cases where it is neither economical nor convenient to weigh the residue as it goes to waste. This is particularly applicable to the residues from counter-current or continuous leaching and extraction operations, as well as to those from many intermittent operations. In such cases the result of a chemical analysis only on the residue merely serves to indicate whether or not a certain relative standard of extraction efficiency is being maintained. While this is sometimes sufficient, it is usually more desirable to know exactly what weight, or what fraction of the total desired constituent originally present in the starting material, is being lost. There is a need, therefore, for some relatively easy method of computing such losses, without actually weighing the residue.

Such a method of computation is available when certain conditions exist in the extraction or leaching process. These conditions are as follows:

1—The starting material must contain no substance other than the desired constituent which is soluble in the reagent used for extraction.

2—The insoluble residue must either remain unchanged in composition during the operation, or if changed, the change must be of such a type that the residue reverts to its original composition on heating.

3—If the desired constituent is extracted as a different compound than that in which it existed in the starting material, the chemical analysis must show in what form the desired constituent remains with the residue.

The last two conditions pertain to operations where the extraction is made with acids, bases or salt solutions. Condition (3) is necessary for extractions of this type when the desired constituent has not been entirely converted to the soluble compound. The chemical analysis, of course, is expected to determine the amount of this insoluble form and the amount, if any, of the soluble compound, which remains with the residue.

When the above conditions are adhered to the loss of desired constituent discarded with the residue may be calculated from one of the following equations. In these equations:

A = Weight of the desired constituent in the starting material per unit weight of starting material. (Dry basis.)

B = Weight of the unchanged desired constituent in the residue per unit weight of residue. (Dry basis.)

B_1 = Weight of the desired constituent in the residue which has been converted to a different compound, per unit weight of residue. (Dry basis.)

(A, B and B_1 are provided by chemical analysis. In sampling the residue it is essential that a true sample of the discarded materials be taken. For example, if the residue passes to waste as a wet slurry after the last leaching, the dried sample of the residue must include all materials in solution as well as the insoluble portion.)

f = Conversion factor of the desired constituent from its original form in the starting material to the soluble compound existing in the residue.

X = Weight of *total* residue per unit weight of starting material.

L = Loss in per cent of the total desired constituent

Case I—When the desired constituent remains in the residue in the same form in which it existed in the starting material:

$$L = \frac{100\,B\,(1-A)}{A\,(1-B)} \qquad (1)$$

The above equation is applicable to ordinary leaching or dissolving operations, such as the leaching of weathered or roasted ores, or to extractions with organic solvents.

Case II—When the desired constituent remains with the residue entirely as a different compound than that in which it existed in the starting material:

$$L_1 = \frac{100\,B_1\,(1-A)}{A\,(1-B_1 f)} \qquad (2)$$

Case III—When the desired constituent remaining in the residue is partly as the unchanged original form and partly as the converted compound:

$$L_2 = \frac{100\,(B+B_1)\,(1-A)}{A\,(1-B-B_1 f)} \qquad (3)$$

Equations (2) and (3) can be used when the extraction is made by means of acids, bases or salt solutions. An example of such an operation is in the extraction of tungstic oxide, WO_3, from wolframite ore by means of caustic soda solution. This results in the formation of soluble sodium tungstate, Na_2WO_4. The insoluble residue is leached further with water but a small amount of

sodium tungstate generally remains and passes with the slurry to a sump. On the dried and ignited sample:

$$f = \frac{Na_2WO_4}{WO_3}$$

If the tungstic oxide has been entirely converted to sodium tungstate, equation (2) is applicable. If the tungstic oxide exists in the residue partly as undecomposed wolframite and partly as sodium tungstate, equation (3) should be used. However, if the analysis shows that the tungstic oxide is present only as unconverted wolframite, equation (1) should be applied. It is evident that each of these three equations is independent not only of the weight of residue, but also of the weight of starting material, and is, therefore, available for control on continuous processes.

The derivation of these equations is as follows:

For case I, insoluble residue = extraneous matter + B. True extraneous matter per unit weight of starting material = $1 - A$; also, true extraneous matter per unit weight of starting material = $X - BX$.

$$X - BX = 1 - A$$

$$X = \frac{1-A}{1-B}$$

Obviously the loss in per cent of the total desired constituent is:

$$L = \frac{100\,BX}{A}$$

Substituting for X,

$$L = \frac{100\,B\,(1-A)}{A\,(1-B)} \qquad (1)$$

Similarly, for case II, insoluble residue = extraneous matter + B_1f. True extraneous matter per unit weight of starting material = $1 - A$; also, true extraneous matter per unit weight of starting material = $X - B_1fX$.

$$X - B_1fX = 1 - A$$

$$X = \frac{1-A}{1-B_1f}$$

and since

$$L_1 = \frac{100\,B_1X}{A}$$

$$L_1 = \frac{100\,B_1\,(1-A)}{A\,(1-B_1f)} \qquad (2)$$

For case III, insoluble residue = extraneous matter + $B + B_1f$. True extraneous matter per unit weight of starting material = $1 - A$; also, true extraneous matter per unit weight of starting material = $X - (B + B_1f)X$.

$$X - (B + B_1f)\,X = 1 - A$$

$$X = \frac{1-A}{1-(B+B_1f)}$$

Since

$$L_2 = \frac{100\,(B+B_1)\,X}{A}$$

$$L_2 = \frac{100\,(B+B_1)\,(1-A)}{A\,(1-B-B_1f)} \qquad (3)$$

These equations may also be derived from a somewhat different basis in the following manner:

Let W = Weight of the starting material.
s = Weight of the desired constituent extracted
y = Weight of the desired constituent in the residue
z = Weight of the other material in the residue.

Then

$$s + y + z = W \qquad (a)$$

$$\frac{s+y}{W} = A \qquad (b)$$

$$\frac{y}{y+z} = B \qquad (c)$$

$$\frac{100\,y}{s+y} = L \qquad (d)$$

From (b), $W = \dfrac{s+y}{A}$

Substituting in (a), $s + y + z = \dfrac{s+y}{A}$ (e)

From (c), $z = \dfrac{(1-B)y}{B}$

Substituting in (e), $s + y + \dfrac{(1-B)y}{B} = \dfrac{s+y}{A}$

$$1 + \frac{(1-B)y}{B\,(s+y)} = \frac{1}{A}$$

$$\frac{y}{s+y} = \frac{B\,(1-A)}{A\,(1-B)}$$

Substituting in (d), $L = \dfrac{100\,B\,(1-A)}{A\,(1-B)}$

= Equation (1)

Equations (2) and (3) may be similarly derived.

Continuous Tunnel Kilns for Silica Brick

THERE is now building at the East Chicago plant of the Harbison-Walker Refractories Company the first continuous tunnel kiln to be applied in this country to the burning of silica brick. The very high temperature of 2,700 deg. F. required by this refractory has previously relegated the manufacture of silica brick to the old periodic round kiln, although ordinary fire brick has been handled for some time in tunnel kilns.

Previous to the decision to replace the periodic kilns, Harbison-Walker conducted extensive experiments with American raw materials at the Heinrich Koppers plant at Dusseldorf. When it had been determined that silica brick could be burned in this manner, rights were acquired to the Koppers kiln and it is understood that, eventually, two more units will be installed at East Chicago and still others in other plants of the company.

The first unit is producer-gas fired on the regenerative principle. It is some 500 ft. in length, including the cooling section, which, in cooling the brick, will provide heat for drying the entering brick and for heating the building. Capacity of the kiln will be 35,000 nine-in. brick per day or in excess of 100 tons.

Magnesia-Graphite Reactions at High Temperatures

By Frank T. Chesnut

Ajax Electrothermic Corporation, Trenton, N. J.

ATTEMPTS made to vitrify the inner surface of a pure electrically sintered magnesia crucible by means of the Ajax-Northrup high-frequency induction furnace have brought to light a very vivid corroboration of the reactions of this material with heated graphite. Temperatures attainable by the method used are limited only to the vaporization point of electrically conducting materials, and to the insulating qualities of refractories at high temperatures.

Since Acheson graphite may be asumed the highest temperature vaporizing conductor of electricity, it is almost universally used in tests of this nature. It has an added advantage that it does not melt and can be shaped to fit any desired need.

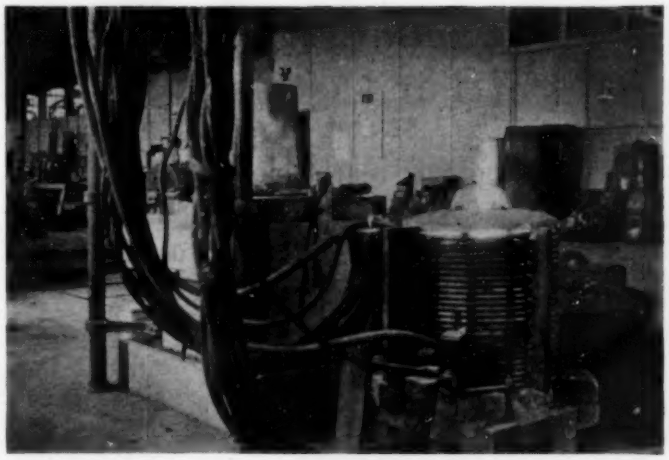
In the test described a furnace coil was designed and properly resonated with a 2,000 cycle source so that by making a crucible of electrically sintered magnesia and inserting within this an Acheson graphite sleeve, a load of 100 kw. could be induced. The coil was approximately a foot wide and of equal height so that the radiation of 100 kw. in the form of heat was improbable. A clay-graphite cover was placed over the furnace and drilled with a sight hole and several other holes through which graphite rods ending in pieces of test refractories could be thrust. The test pieces consisted of high melting-point oxides forced into holes in the ends of the rods.

With 100 kw. applied to the furnace the graphite sleeve heated very rapidly. In 17 minutes the test pieces began to shrink, then melted, or were reduced and vaporized. Generally a melting was effected before reduction set in, so a rough gage of temperature was given. Chromium oxide melted in 17 minutes; silica in about the same time and probably vaporized in 25 minutes; magnesia slumped at 24 minutes and was reduced in 28 minutes. Heating was continued for some time after the final test piece had disappeared and it is not unreasonable to believe that the graphite sleeve had reached a temperature close to 3,000 deg. C. or possibly higher.

At low temperatures a flammable gas was evolved which seemed to be due to impurities and to surface coatings of the materials used. At slightly higher temperatures the flame became white and showed signs of the breaking down of the magnesia. At higher temperatures still, the generation of gas became voluminous and the white flames were projected into the air through the sight holes and around the edge of the cover. When the power was finally cut off the reaction had about reached a point where it would continue without added external power, and seemed to increase for a period of five or ten minutes.

There seems to be a disrupting of the molecules at high temperatures and a liberating of free magnesium, oxygen and carbon, which react on cooling, and on meeting the air outside the furnace. After the furnace had cooled sufficiently to allow observation, it was found that the magnesia had not been visibly vitrified. A goodly supply of flake graphite was formed during the reaction.

The reaction described is not new but is very pronounced in the electric furnace, and verifies, in a popular way, preceding experiments of this nature.



150 Kw. Ajax-Northrup High-Frequency Test Furnace

Magnesia-Graphite Reaction at Temperature of About 3,000 Deg. C.

Pacific Coast Pulp and Paper Conference

THE first conference of the men engaged in the manufacture of pulp and paper on the Pacific Coast was held at Seattle, October 26. The meeting was called in response to a desire on the part of the technical men in the industry to form a permanent organization. H. K. Benson, professor of chemical engineering at the University of Washington, together with his colleagues and several executives of the industry, were responsible for the gathering and for the program.

After a session at which many interesting papers were presented a dinner was held. Lloyd Spenser of the *Post Intelligencer* acted as toastmaster, Senator Pliny Allen responded for the Seattle Chamber of Commerce, Dean F. M. Padelford for the University of Washington, Prof. J. S. Fulton, of Oregon State College, for Oregon and B. T. McBain for the National Pulp and Paper Association.

At the conclusion of the dinner, H. K. Benson presided at a meeting attended by forty-five of the delegates directly interested in the possible formation of an organization. After a very general discussion it was unanimously agreed that the chairman should invite each operating mill to designate a representative to serve on a committee to work out plans for future meetings and conferences of the pulp and paper industry on the Pacific Coast.

Steel Corporation Enters Field of Tar Distillation

May prove a factor in relieving occasional shortage and market instability in creosote oil situation

DESPITE the fact that the consumption curve shows an even and steady increase, the creosote-oil market is one of the most difficult to forecast. Much of this has been due to the increasing recognition of the necessity and correct economics of timber preservation. Consumption in wood-treating plants in the United States during the past 10 years has been increasing as follows: In 1918, 52,775,000 gal. was consumed. The following year accounted for 65,000,000 gal. and in the following eight years the consumption in round figures ran as follows: 68,000,000 gal., 76,000,000 gal., 86,000,000 gal., 127,000,000 gal., 157,000,000 gal., 167,000,000 gal. and 185,000,000—until in 1927 nearly 220,000,000 gal. was consumed.

The difficulty of forecasting does not lie then in estimating the consumption. Nor is there any particular difficulty in making a reasonably accurate estimate of the available raw material from which creosote may be produced in America. The probable future of the coal-tar supply in England and Europe generally, however, is a different matter. The iron and steel industries there undoubtedly are recovering from the depression of the last few years and new byproduct coke plants are coming into operation. But abroad the tar distiller makes as little creosote oil as possible, particularly at a time like this, when the pitch market is weak.

Europe has a demand for briquetting pitch which this country does not enjoy, but despite this the European distiller finds a more profitable business in merely topping his tar, i. e. removing the water and light oils and selling or utilizing his finished product for the manufacture of road making materials. The tar may be used as such, or as tarred slag or tarred limestone. Thus many of the English distillers have their own quarries where they tar the aggregate, and from which they deliver the hot and tarred road metal in large motor trucks direct to the road contractor.

European road building and road re-construction programs therefore have an immediate and important influence upon the quantity of creosote oil available for export. This is immediately confirmed when one considers that, despite general business recovery in Europe in the past few years, less creosote was imported into this country in 1927 than in 1926 and the imports for the first half of 1928 are less than they were in the first half of 1927. It is significant, too, that the imports of creosote oil into this country from Canada have decreased.

If it is assumed, and it may fairly be done, that English and European road programs will continue to use increasing quantities of road tar, then a forecast narrows down to the consideration, namely: to what extent will increased production in the United States offset America's rapidly increasing consumption?

In the late Judge Gary's last annual address to his stockholders he touched very briefly upon the possibility of the United States Steel Corporation producing creosote oil. It is possible that national economics and better conservation of resources were the determining factors in the decision of the Corporation to embark upon an industry not heretofore directly connected with the steel business. Also the extensive creosoting operations of the many railroads of this country have been seriously handicapped, from time to time, by market disturbances and shortages. It must have been evident to the Steel Company officials that while tar as such is a valuable fuel for open hearths and other heating furnaces in steel works, either producer gas or fuel oil may also be used to good advantage.

WHATEVER may have been the cause, the fact remains that shortly after Judge Gary's address the Corporation proceeded to erect a large and well equipped tar distillation plant. Clairton, Pennsylvania, near Pittsburgh, where the Corporation operates the largest unit of coke ovens in the world, was chosen as the logical site. The plant now consists of over 1,500 ovens and is carbonizing daily about 30,000 tons of coal. The Clairton coke ovens operate on just one class of uniform high grade coking coal ("Klondike" basin) of which possibly a 90-years supply is in sight. The tar obtained from the distillation of this coal is of an unusually high quality, and yields a superior creosote from a wood preserver's point of view.

This new project was approached by the Steel Corporation with unusual care. A thorough survey was made of the best practice here and abroad; and over a year was spent in the preparation of the plans before construction began. The design, erection and first operation of the Clairton tar plant was handled by Robinson, Butler, Hemingway & Company of New York, the engineers who, some two years ago brought into operation as half owners, the plant of the Inland Tar Company, in conjunction with the Inland Steel Company of Chicago.

This plant, which has now been in full operation for two or three months, is, obviously, one of the important factors to be considered in a general forecast of the creosote oil market, for it represents, in one unit, an output equal to almost one half of the country's natural consuming increase shown between 1926 and 1927.

Its entry into the field will, in all probability, stimulate American distillers to further efforts and the summation of these new circumstances may result in the avoidance in the future of such acute shortages as have occurred in the past. In any event it appears certain that this new and sizable source of production will be helpful to the consuming interests.

Producing Pure Manganese

BY A PROCESS of vacuum distillation, pure manganese has recently been produced in the Bureau of Metallurgical Research of the Carnegie Institute of Technology. Samples of the metal, which never before has been produced in quantity in such a purified state, and of the furnace in which it was made were exhibited at the open meeting of the Metallurgical Advisory Board held in Pittsburgh October 19.

Pure manganese has a bright silvery luster and unlike many pure metals which are soft and ductile, it is extremely brittle and hard enough to scratch glass. The pure metal was distilled from crude metallic manganese placed in a pure magnesia crucible over which a similar crucible was inverted to condense the manganese vapor. The whole was placed in a closed silica tube connected with a high vacuum pump and heated by high-frequency induction using an a.c. current of several amperes at a frequency of 20 kilocycles.

Readers' Views and Comments

An Open Forum

The editors invite discussion of articles and editorials or other topics of interest

The Prodigious Pace of Science

To the Editor of Chem. & Met.:

Sir:—Undoubtedly you are familiar with the ubiquitous prodigality of oil shale distillation, so I will not presume to enumerate the manifold products and by-products. Besides, any such tabulation would doubtless be antiquated ere this communication reaches you—so fertile are the fields daily discovered by the more enthusiastic and altruistic pioneers of the industry.

It is not as a technical novelty, therefore, that I call your attention to a recent Delaware incorporation for the production of "rubber" from shale. Rather, I would point out to you what appears to be a significant relationship between heredity and success in our profession. It seems that the gentleman who discovered this process "has been a chemist for over half a century." As if that were not enough, "his grandfather was a Philadelphia chemist." Mark you, sir (law journals please copy), a *Philadelphia* chemist. And finally—believe it or not —"his great-grandfather was a chemist in Paris."

Now, sir, with the welfare of our profession at heart, I submit this quandary: Can we not devise some means of making more general such admirable selection of our forebears or may we assume that the next generation can dispense with our services in view of the abundance of all the necessities and luxuries of life to be produced from oil shale?

MARTIN SEYT.

To Market Shale Rubber

Delaware Shale-Rubber Products Co., which was organized May 4 last to manufacture a rubber-like material from shale, has established its main office at 1007 Subway Terminal Building, Los Angeles, Calif., and selected these officers: President, King C. Gillette; first vice-president, Monte L. Cambran; second vice-president, Augustus R. Lendner; treasurer, Herman O. Langstaff; and secretary, T. H. Rosenberger. All are residents of California, the president being the well-known razor manufacturer. The company has an authorized capital of 100,000 no par shares, and is permitted to issue 40,000 shares for patents obtained by Mr. Lendner, chemist, of Perris, Riverside County, on a process for the production of a gummy substance which, it is claimed, can be used up to 61 per cent in a rubber compound such as tread stock, effecting much economy. Options have been taken on large tracts of oil-bearing shale lands near Perris, and later the company's operations may be carried on in other sections where suitable bituminous material may be obtained on a large scale from shale deposits. The process chiefly involves the treating of the heavy hydrocarbon fluid with vegetable matter at a high temperature. Mr. Lendner has been a chemist for over half a century, his early life being spent in Washington. His grandfather was a Philadelphia chemist, and his great-grandfather a chemist in Paris.

* * * *

Centrifugal Salt Drying

To the Editor of Chem. & Met.:

Sir:—I desire to call attention to a statement made with reference to centrifugal machines in salt plants in the article on continuous vacuum filtration by Mr. E. D. Flynn appearing on page 575 of the September issue of your journal.

It is stated here that, "with centrifugal operation, the salt crystals discharged have a moisture content in the neighborhood of 3.5 per cent." You may be interested in knowing that there is a record in a large salt plant in the Middle West where 48-in. centrifugals furnished by me have dried 600 tons of salt per day for a whole month in which the average moisture content was 2.48. In fact, the record for many of the centrifugals installed in the salt plants throughout the United States is an average of 2.5. These are electric and water driven machines equipped with open-bottom baskets and working on 5-minute cycles.

D. J. LEWIS, JR.,
Sales Agent,
New York, N. Y.

* * * *

Simplifying Instrument Problems

To the Editor of Chem. & Met.:

Sir:—We were very much interested in the suggestions given by Mr. Fred Emmarr in his discussion "Standard Charts and Instruments" in *Chem. & Met.* for October.

We do not know whether Mr. Emmarr is connected with the manufacture of competitive instruments or not, but he certainly has made a series of suggestions which, if carried out by the plant engineers or those responsible for instruments, would simplify the problem of each instrument manufacturer. We heartily endorse each one of these eleven suggestions which he has made.

A. W. CHASE.
Sales Engineer,
The Foxboro Company.

* * * *

Professor Curtis Excepts

To the Editor of Chem. & Met.:

Sir:—Who are the jokers on your staff? I am looking at pages 430-431 of the issue of July, 1928. On the latter page the term "Steinkohlenkoks" is translated "Anthracite coke," while on page 430 I note a book review under the title of "The Rare Gases in Abegg." This ought to be called to the attention of our Navy Department which is always on the lookout for new sources of helium.

HARRY A. CURTIS,
Professor of Chemical Engineering,
Yale University.

* * * *

Lithopone Filtration

To the Editor of Chem. & Met.:

Sir:—On page 556 of the September issue of *Chem. & Met.* the writer referred to the suction filter employed in the manufacture of lithopone in the plant described as an Oliver filter. The word "Oliver" was used in error, for the equipment in question is the Feinc filter especially designed and built by Filtration Engineers, Inc., for use in lithopone manufacture, and is not manufactured by the Oliver Filter Company or the United Oliver Company.

C. L. MANTELL.
Pratt Institute,
Brooklyn, N. Y.

Chemical Engineer's Bookshelf

Chemical Engineering Research Confronts the Business Man

The Handwriting on the Wall. By *Arthur D. Little*. Atlantic Monthly Publications, Little, Brown and Company, Boston, 1928. 287 pages. Price, $2.50.

Reviewed by Ellwood Hendrick

"The Handwriting on the Wall" is no less than a missionary tract on behalf of science for the business man. Dr. Little has the subtle art of telling of the incidence of research on industry in simple, easy-reading language that anybody who is above the tabloid-reading sort, that needs pictures to expound words of more than one syllable, can understand. And again (except to the same group whose only literary criticisms are "Hully Gee, I t'ought I'd die laughin" and, "Aw, hell, it's punk"), he infuses his own quality of humorous good fellowship into his writing. He possesses indeed an unusually facile and engaging literary style. He is careful about his facts and he uses statistics as literary embellishments.

The book consists of articles and addresses with some of which many of *Chem. & Met's.* readers will be familiar. Put together, they constitute a caution as to the hazard of neglect of research, with numerous examples of how disasters have been avoided as well as how successes have been launched.

Directors of corporations unfortunately are seldom under any other discipline than the Voice of Conscience, and that is not always active. But if, under the tendency of super-organization that is coming into vogue, they should pass under intelligent surveillance, I can think of hardly a better item of General Instructions to the Directors of Associated Corporations than a paragraph prescribing this book to be read diligently and carefully without delay.

The work is replete with information that we have been trying for years to get into the minds of men responsible for the scientific conduct of industries and the prosecution of intelligent research, with only moderate success. It is an ingenious attack upon the minds of the very few men we want to reach. Of course it does not cover every industry, but the examples are so numerous and so well-chosen that it drives straight home the idea of research as the mother of industry.

The several chapters are: The Handwriting on the Wall, The Contribution of Science to Manufacturing, Chemistry as an Investment, The Trend of Development, The Chemical Industry, The Sinews of War, Misapplied Chemistry (which includes an illuminating list of chemical fakes, not forgetting our exposition of Enricht's Easy Money from Peat), Making the Most of America, and The Fifth Estate, which is the celebrated Franklin Institute Centenary Address on the Aristocracy of Science.

The book is so darned good that I was almost tempted to write an adverse criticism of it as coming from the pen of Mr. George F. Babbitt; and I should have attempted to do so if I had not learned by experience the danger of trying to be funny in print.

Nitroglycerine Manufacture and Uses

Nitroglycerine and Nitroglycerine Explosives. By *Phokion Naoum*, Translated by *E. M. Symmes*. The Williams & Wilkins, Company, Baltimore. 469 pages. Price, $7.

Reviewed by G. St. J. Perrott

Sobrero's discovery of nitroglycerine in 1847 and its practical utilization as a result of the brilliant work of Alfred Nobel some twenty years later marked a new era in the development of explosives. Today practically all of our commercial dynamites contain nitroglycerine as the active base. Naoum's book published in 1923 was the first comprehensive work on the subject and the English translation by one with wide experience in the field is a welcome addition to the literature of explosives.

Part I deals with nitroglycerine including methods of manufacture; specifications for the raw material and the finished product; physical, chemical, and physiological properties; and nitroglycerine as an explosive.

The subjects considered in Part II are the homologous and related nitric esters, including tetranitrodiglycerine, nitroglycol, and other low-freeze ingredients. It is of particular value to the research worker in this field.

Part III treats of the dynamites containing nitroglycerine, including powdery dynamites, gelatine dynamites, low-freezing explosives, and nitroglycerine explosives permissible in gassy and dusty coal mines. A supplement contains a brief treatment of methods for the analysis of explosives containing nitroglycerine.

The author has included a wealth of experimental data on chemical, physical, and physiological properties of nitroglycerine and the related nitric esters and discusses the explosive properties very fully. Much of the data is taken from the author's own researches. Formulae of various dynamites are given together with their explosive properties. References to the technical and patent literature are complete and the value of the book is increased by the translator's notes concerning American practice. The book should be of value both to the manufacturer and the research investigator.

* * * *

Industrial Heating Furnaces

Practical Industrial Furnace Design. By *Matthew H. Mawhinney*. John Wiley & Sons, Inc., New York. 318 pages. Price, $4.

Reviewed by L. A. Mekler

As stated in the preface by the author, the book "is simply a discussion of practical methods for the solution of the problems and difficulties most frequently met in the selection, design and operation of industrial heating furnaces." The few theoretical discussions are limited to general statements and are compilations from other authorities, particularly Prof. W. Trinks. The book contains a number of sample calculations in furnaces based mainly on empirical data from actual practice and experience of the author.

A short description of the different methods of handling of materials in continuous heating furnaces is given, together with drawings and photographs of the

equipment and arrangements successfully used in the industry. Chapters 6 and 7 are devoted to refractory design and construction of furnaces and the design of the metal parts and auxiliaries, and contain tables, curves and other data that makes them of particular value to a designer of the conventional types of industrial heating furnaces. The last chapter is devoted to examples of different furnace calculations and illustrates the use of the various tables and charts in the book.

The book should be of particular value to those in technical charge of heat treating plants.

* * * *

CHEMICAL ENCYCLOPAEDIA. By *C. T. Kingzett.* D. Van Nostrand Company, New York, 1928. 807 pages. Price, $10.

When a book runs into a fourth edition, the indications are pointed that the work is worth its shelf room. Mr. Kingzett has considerably enlarged the scope of this volume in the present revision of his third edition which appeared in 1924, adding some 200 pages. While perhaps the title suggests a coverage even more ambitious than has actually been the case, while perhaps the book is not truly "encyclopaedic," it fills a definite niche between the so-called chemical dictionaries and such a monumental reference library as the complete Thorpe. For between two covers, between "Abietic Acid" and "Zymogen" there are some 16,000 to 20,000 items covering in a condensed but not unscientific manner the vast majority of the more common chemical materials, excursions into pure, physical and applied chemistry and some discussion of many of the terms that have been born with chemical engineering. In addition, many proprietary names appear, more frequently than not strange to American ears in view of the book's British origin, but striking home with sufficient frequency to justify their inclusion in a volume intended for distribution on this side.

* * * *

HANDBOOK OF PETROLEUM, ASPHALT AND NATURAL GAS. By *Roy Cross.* Bulletin No. 25 (1928 revision), published by Kansas City Testing Laboratory, Kansas City, Mo. 833 pages. Price, pocket edition, $10.

During the past twenty years Dr. Roy Cross' personal notes on petroleum and related products have grown from a small loose leaf compilation to a well-rounded reference manual of data on every phase of production, transportation and refining. It differs from the usual engineering handbook in its inclusion of economic and statistical information on world production and its critical studies of such subjects as cracking, corrosion, health hazards, and petroleum laws and taxes. In short, it is the type of handbook that gives the petroleum technologist not only the answers to his detailed problems, but the broader view of the economic and technical trend within his industry.

* * * *

THE LABORATORY INVESTIGATION OF ORES. A Symposium. Edited by *Ernest E. Fairbanks.* McGraw-Hill Book Company, New York, 1928. 262 pages. Price, $3.50.

Thirteen contributors have written the chapters that constitute this symposium. The object in its selection and presentation was, not to exhaust the field of ore investigation, but to indicate its present status and the dormant possibilities. Through his choice of authors and matters, the editors can fairly expect to excite renewed research along some of the unemphasized but promising directions.

WHO'S WHO IN THE CHEMICAL AND DRUG INDUSTRIES. By *Williams Haynes.* Published by Haynes Publications, Inc., New York. 438 pages. Price, $6.

That the chemical and drug industries have reached a stage in their development to warrant this attempt to catalog their leaders and personnel, is indeed a happy sign of the times. Assembling these records in a permanent and readily accessible volume cannot help but knit these industries closer together in their human as well as business relations. Furthermore, this volume, ingeniously indexed as it is, alphabetically, as geographically, and by firms, will be helpful to all within and without the industry who have contact with its personnel. As the first edition, it obviously contains a number of errors of commission and omission, but these will naturally be corrected as the usefulness of the compilation makes it necessary to publish new and revised editions.

* * * *

PRACTICAL COLOR SIMPLIFIED. By *William J. Miskella.* Finishing Research Laboratories, Inc., Chicago. 1928. 109 pages + color charts. $3.50.

While the primary attention in this book is directed toward the practical application and selection of colors, some of the material is also of potential use to the engineer and manufacturer, as in matters of lighting, illumination and distinctive marking around the plant. The text as a whole is plainly written and hence generally understandable and interesting. Not the least feature of the book, however, is the set of appended color charts, skillfully devised to show what is actually the effect of combining colors. Its appeal, while not severely technical, is general and practical.

* * * *

THE MINERAL INDUSTRY, Its Statistics, Technology and Trade during 1927. Edited by *G. A. Roush.* McGraw-Hill Book Company, New York, 1928. 766 pages. Price, $12.

Once more this guide-book to the mineral industry has made its appearance, now as the thirty-sixth of its kind. The effort is being ever more successfully made to enlist contributors with a broad contact in their fields: in the volume's new appearance, this fact is gratifyingly apparent, in addition to its customary and well-known features.

* * * *

FINDING AND STOPPING WASTE IN MODERN BOILER ROOMS. Edited by *George H. Gibson.* Cochrane Corporation, Philadelphia, 1928. 788 pages. Price, $3.

The Cochrane Corporation is to be congratulated for the general excellence of this third, revised and enlarged edition of its handbook for the power man. Within its field it considerably enlarges upon the scope of the standard works, Marks and Kent, including as it does a critical digest of the work of a great number of investigators eminent in power generation and utilization. Its sources include papers read before engineering societies, reference books, articles appearing in technical periodicals and publications of the Bureau of Mines.

Its five sections covering the subjects of fuels, combustion, heat absorption, boiler efficiency and testing, and feed water heating and conditioning are written to appeal to the technical man as well as his practical contemporary, to the owner, the superintendent and the fireman, enabling each to recommend or carry out practices that permit of greater boiler plant efficiency than has normally been obtained in the past.

MESSEN UND WÄGEN. By *Walter Block*. Otto Spamer, Leipzig, Germany, 1928. 339 pages. Price, 25M.

Prepared with especial regard for service in chemical fields, this work has succeeded in encompassing a surprisingly broad matter within a reasonable bulk. A historical induction is followed by a general consideration of measuring systems, devices and constants. The main body of the book, however, is subdivided into the separate applications of measurement, such as time, angles, length, temperature, heat, light, optics, and electricity. Weighing proper is treated in a single chapter.

The presentation is made in a minimum of words, the method and functioning in each case being explained clearly and in the light of the necessary theoretical matter. In view of the author's express emphasis on chemical applications, the work assumes an additional utility in that field. Numerous illustrations illuminate both the subject matter and the clearly printed text. Its sole disadvantage to most will be that it is written in German.

* * * *

A.S.S.T. HANDBOOK. 1929 Edition. American Society for Steel Treating, Cleveland, Ohio. 582 pages + indexes. Price, free to members; $5 to Institute of Metals members; and $7.50 to non-members of either institute.

After publication of the Handbook for nearly five years in loose-leaf form it is now issued in a binding. The Recommended Practice Committee states that its aim is to so design and make up this Handbook that it will be a volume of comprehensive and concise information on metallurgical practices, pertaining to the manufacture, treatment, and use of metals.

The initial appearance of the Handbook in bound form should be heartily welcomed and appreciated by the metallurgical engineer, for a journey through the pages of this volume impresses the reader with the wealth of data assembled. Truly a great service has been performed by the American Society for Steel Treating in the publication of this book.

* * * *

PROCEEDINGS OF THE NATIONAL FERTILIZER ASSOCIATION, Fourth Annual Convention. Published by the Association, Washington, D. C., 1928. 180 pages.

A complete record of the proceedings of the association's June convention at Old Point Comfort, Va., containing the addresses, papers, and reports.

* * * *

BOOK OF A.S.T.M. STANDARDS, 1928 Supplement. American Society for Testing Materials, Philadelphia. 168 pages. Price, $1.50.

In arrangement this book supplements, as a whole and by its sections on metals and non-metals, the last complete triennial edition of the "Standards" which appeared in 1927. It contains 10 revised and 31 newly adopted standards approved on September 1, 1928.

* * * *

PROCEEDINGS OF THE AMERICAN GAS ASSOCIATION. Ninth annual convention, 1927. Published by the Association at 420 Lexington Ave., New York. 1,478 pages.

In reality this sizable volume contains rather more than just the proceedings, although the additional matter is all of kindred interest. The extensive committees are listed and the remainder of the material is divided into the general session and the various individual sections.

Miscellaneous Publications

The Causes of Failure of Wrought Iron Chains, by H. J. Gough and A. J. Murphy. Special Report No. 3, Engineering Research Division, Department of Scientific and Industrial Research (British). Copies may be obtained from The British Library of Information, 44 Whitehall Street, New York City.

Natural Resources and National Problems, by Henry Mace Payne. Issued by American Mining Congress, Washington, D. C. A discussion of the economic significance of transportation and freight rates, taxation, public vs. private ownership, power, labor and immigration, and the interdependence of agriculture and industry.

Thermal Expansion of Fireclay Bricks, by A. E. R. Westman Engineering Bulletin No. 181, University of Illinois. 20 cents.

Laboratory Furnace for Testing Resistance of Firebrick to Slag Erosion, by R. K. Hursh and C. E. Grigsby. Engineering Circular No. 17. University of Illinois. 15 cents.

Investigations of Fuels and Fuel Testing, 1926. Department of Mines, Ottawa, Canada.

Investigations of Mineral Resources and the Mining Industry, 1926. Department of Mines, Ottawa, Canada.

The Cracking Art in 1927. By Gustav Egloff and C. D. Lowry, Jr. Reprinted from the *J. Inst. Petroleum Tech.* of August, 1928, by the Universal Oil Products Company, Research Laboratories, Chicago, Ill. 79 pages.

Notice of Infringement Not Required in Process Patent

DECISION was handed down by the U. S. District Court of New Jersey sustaining T. B. Wagner in an action against the Corn Products Refining Company for the recovery of damages on an alleged infringement of U. S. Patent 835145, issued in 1906. The patent involves a process of manufacturing anhydrous grape-sugar from corn and the like, and was issued when the plaintiff was in the employ of the defendant.

The case brings up the questions of "product" and "process." The defendant entered a motion to strike out the complaint, since the process was admittedly not marked as patented; it was necessary to prove, however, that processes must be marked in order to make infringement possible. The motion was denied on the grounds that previous decisions had failed to indicate this interpretation.

The defendant contended that the 1870 act, carried forward as section 4900 R. S., included processes; this interpretation was not given in a ruling case, however, since a process, not being a tangible article, cannot be marked. In the other cases brought up for precedence the patents were also clearly on products, not on processes. However, while none of the cases cited were convincing, the case of Parker Dust Proof Co., vs. Ford Motor Co. did involve processes. Inspection of the judge's evidence showed that he also had relied on product patents, hence again rendering his decision unsuitable for the current case.

The plaintiff's patent expired several years ago and he entered no complaint at the time of its alleged infringement. The question of marking is therefore of essential importance in the case.

Selections from Recent Literature

Bartling Process. David Brownlie. *Gas Age-Record,* Oct. 6, pp. 442-4. The Bartling process of carbonizing powdered coal entered the large scale experimental stage in 1927. Powdered coal is blown by a gas blast through a nozzle against the heated steel wall of a low, wide retort in such a way that low temperature carbonization of the particles is effected in a few seconds. Dust difficulties, one of the main obstacles to carbonizing powdered coal, are eliminated by using with the retort a Coriolis separator in which the gas is passed betwen a stationary and a high speed rotating disk, spaced very close together. An installation of retort with separator is illustrated. Results from actual operation are not yet available, but the process is interesting in connection with city gas manufacture.

Glass Tank Furnace. R. D. Pike and G. H. West. *Journal of the American Ceramic Society,* Oct., pp. 734-44. A 72-hour test was made on a continuous side-fired regenerative glass tank furnace to ascertain its heat balance. Fuel economy is favored by a rapid rate of working, but this rate is governed by the capacity of the machines drawing glass from the furnace (in this case, automatic bottle machines). Quantitative results of the test indicate the possibility of saving about 14 per cent of the fuel actually used. Such savings would result from improved combustion control, insulation and leakage control in the regenerator, and stopping leakage of combustion gases. Tables and diagrams are given.

Gas From Tar. *Teer und Bitumen,* Sept. 20, pp. 465-9. To obtain tar-free gas, coal powder must be removed from the tar (tolerance, about 5 per cent). Mist formation, one of the principal difficulties in tar recovery, can be avoided by very slow cooling from above 300 deg. C. The two principal methods of purifying tar distillates (by condensation and by scrubbing) have each their own difficulties and their own field of usefulness. The scrubbing method was adopted when direct recovery of ammonia came into works practice, making it desirable to free the gas from tar beforehand. Hot scrubbing has several advantages over cold scrubbing, but is not applicable to producer gas from raw lignites because with such gas there is too much loss in heat value.

Baking and Japanning. W. A. Darrah. *Gas Age-Record,* Sept. 15, pp. 315-8. The fundamental principles involved in operations of drying, baking and japanning are: heat production, heat transfer and application, solvent treatment and recovery, and mechanical handling. Efficiency in production and utilization of heat are greatly aided by a well designed system of recirculation of the hot gas. Heat transfer by conduction is not applicable in the processes under consideration; transfer by radiation is effective at high temperatures but much too difficult to control. The recirculation system increases the operating efficiency of the only remaining means of heat transfer, namely convection. Its advantages include heat economy, rapid and uniform heating, safety and ease of control. Some installations are described and illustrated.

Melting Plant. J. McLachlan and C. A. Otto. *Iron & Steel Industry,* Oct., pp. 25-8. Equipment and appliances used in melting metal in modern foundries are described and illustrated. These include fans, blowers and cupola accessories. The importance of designing the cupola and its blower equipment for maintaining a constant correct air supply is emphasized. Use of variable speed motors for blower drive facilitates control. The blast pipe should be long enough to act as a reservoir, compensating to some extent irregularities in the air supply.

Drying Fuels. A. Grunwald and W. Liesegang. *Braunkohle,* Sept. 29, pp. 885-90. Growing necessity for efficiency and heat economy have led to introduction of methods and instruments for scientific control in the drying of solid fuels such as lignite, which is dried in rotary drum driers on the direct current principle. Instruments include a steam meter with automatic visible or audible signal when a set limit is passed, and with recording device; an ardometer for control of the powdered coal supply to the burner; a thermo-electric pyrometer, and recording pyrometers showing the gas temperatures entering and leaving the burners and during combustion. Illustrated with photographs and diagrams.

Metallurgical Limestone. Oliver Bowles. *Blast Furnace,* Oct., pp. 1308-12. Limestone, when used as flux in a blast furnace, is first calcined, then reacts with the impurities in the metal to form a slag. Precalcined lime reacts more readily, but does not justify the added cost of precalcination. The common impurities in limestone are about the same as in the ore. Since the flux must carry off its own impurities as well as those of the ore, it must be as pure as possible. The ratio of Mg to Ca in the limestone may vary widely; its importance is still a moot question, the high Ca and the dolomitic limestones both having their advocates. The size of stone should be fairly uniform and not too fine (retarding the draft) nor too coarse (very large lumps do not calcine completely). Rate of assimilation is an important factor which has not yet received sufficient attention.

Contact Catalysts. B. Neumann, H. Panzner and E. Goebel. *Zeitschrift für Elektrochemie,* Oct., pp. 696-704. A comparative study was made of the activity and behavior of platinum, silver vanadate, vanadic acid, vanadic acid with copper vanadate, silver, tungstic acid as catalysts in the contact process of making sulphuric acid. Maximum yields and optimum temperatures were determined. Next to platinum (over 99% yield) the most active catalyst was silver vanadate (97%). Yields of over 90% were obtained with vanadic acid, alone and with copper vanadate; but silver gave very poor yields (less than 40%). Tungstic acid is active, but less so than vanadic acid. Experiment showed that in vanadic acid catalysis vanadyl sulphate is formed as an intermediate.

Benzene Hydrocarbons. Franz Fischer. *Brennstoff-Chemie,* Oct. 1, pp. 309-16. In experiments on the pyrogenetic conversion of methane to aromatic hydrocarbons, it was shown that the conversion can be effected under ordinary pressure and at room temperature. The process is complex and the voluminous patent literature claims other than aromatic compounds as products, with the sole exception of the I. G. patent, in which benzol production is specified. While the yields so far obtained have not been large, they can probably be materially increased by increasing the amount of gas reacting. Thus, 63.5 g. of methane yielded 5.7 g. of (aromatic) light oil, 1.1 g. of tar and 3.7 g. of unsaturated hydrocarbons; but only 12 g. of the methane reacted.

Factory Floors. F. Heron Rogers. *Chemistry & Industry,* Oct. 5, pp. 1011-21. Design and construction of ground floors and supported floors, and choice of foundation and surfacing materials, are considered in the light of the conditions to be met and uses to be served. Important factors include load, vibration, heat and sound conductivity, resilience, resistance to chemicals and comfort of operators using the floor. Tables are given of modulus of elasticity and heat conductivity of metals, brick, stone, concrete, various woods, rubber, cork, linoleum and bitumens. Ventilation and illumination as related to floor design are considered. Diagrams are shown of various combinations of subflooring and surfacing, and of features of construction.

Gravity Recorder. Erik K. H. Borchers. *Chemische Fabrik.* Oct. 10, pp. 594-5. A new automatic recording specific gravity meter for liquids operates on the principle of bubbling air through the open ends of two tubes dipped in the liquid. If the immersion depth is known and constant, one tube is sufficient. The recording device is operated in the desired location by pressure from an inverted float communicating with the two tube outlets in such a way as to show the pressure gradient between the two, this gradient being a simple function of the specific gravity.

COLLOID MILLS. Felix Hebler. *Chemische Fabrik.* Oct. 3, pp. 581-2. If the term "colloid mill" be strictly interpreted, no such machine has yet been made. It is true that the Plauson mill, for example, grinds to colloidal fineness (0.1 μ or finer) a certain portion of a charge with a reasonably small expenditure of power. But to increase this fraction requires a disproportionate increase of power input; and no amount of power suffices to grind all, or even approximately all, of a charge to colloidal fineness. This conclusion was confirmed by actual experiment with a "colloid" mill. The fineness was measured by the sedimentation method.

WELDING GASES. J. Bronn. *Chemische Fabrik,* Sept. 26, pp. 569-70; Oct. 3, pp. 584-5. Methane, in spite of its low cost and high heat value, is not satisfactory for soldering or welding. Apparently the reason is that its rate of combustion is too slow; this limits the possible rate of feed of the gas to the orifice and dissipates the heat too much from the point of application. Hydrogen, on the other hand, is low in heat value but its rate of combustion is about ten times faster. Experiments were therefore made wit hblends of hydrogen and the methane fraction from coke gas. For lead soldering, a 50:50 mixture saved 48 per cent in fuel and 9 per cent in time. For autogenous welding of iron, of various blends, a methane: hydrogen 37:63 mixtures saved 67 per cent in fuel, 25 per cent in oxygen and 10 per cent in time. (The comparisons are with hydrogen welding). Similarly, blends can be made to suit the special conditions of any welding job, with or without fluxes. Methane-acetylene blends are also useful for some cases, as where acetylene alone gives too high a temperature.

TAR DISTILLING. W. Karsten. *Teer und Bitumen,* Sept. 1, pp. 433-6. The customary construction of horizontal tar distilling retorts is essentially an imitation of the steam boiler. There is not sufficient allowance for expansion at the high temperatures used; and the masonry uselessly absorbs and wastes a large amount of heat. If heating pipes are passed through the retort, pipe and retort expand differently and joints cannot be kept tight. The Weickel horizontal retort (patented) obviates these difficulties by using no masonry and providing a U-tube heating arrangement which is independent of the retort itself and therefore quite responsive to thermal expansion and contraction. It is adaptable for either continuous or batch operation; two or more retorts can be connected in series for continuous distilling and for heat economy; the distillation is carried out in vacuum. Diagrams are shown.

NITRIC ACID PRODUCTION. Bruno Waeser. *Chemische Fabrik,* Sept. 5, pp. 529-30; Sept. 12, pp. 544-6. Behavior of metals toward nitric acid in various concentrations is compared, with reference to the usefulness and service life of these metals when employed for nitric acid retorts, evaporating dishes, and for pumps, valves, pipe, molds, reaction vessels and the like to be used in handling nitric acid. The metals include Al, Cr steels, Cr-Ni steels (the VA metals) and alloys of Fe and Si (Duriron, Thermisilid, Acidur, Corrosiron, etc.) and alloys of Fe with both Si and Cr (Wegucid). Comparative tables, showing the rates of attack on these metals by nitric acid, in low to high concentrations, are cited. Stability toward other corrosive chemicals is also considered, particularly for Thermisilid.

Government Publications

Documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. Send cash or money order; stamps and personal checks not accepted. When no price s indicated pamphlet is free and should be ordered from bureau responsible for its issue.

Co-operative Marketing. Report of the Federal Trade Commission to the Senate, giving results of a study of comparative costs, prices, and marketing practices, as between co-operative marketing and organizations and other types of marketers and distributors handling farm products. Senate Document No. 95, 70th Congress, 1st Session.

Census of Dyes and of Other Synthetic Organic Chemicals, 1927. U. S. Tariff Commission Tariff Information Series—No. 37. 30 cents.

The Italian Chemical Industry, by E. Humes, Assistant Trade Commissioner, Rome. Bureau of Foreign and Domestic Commerce Trade Information Bulletin 577. 10 cents.

What to do in Case of Accident. U. S. Public Health Service Miscellaneous Publication 21. 15 cents.

Cause and Prevention of Kiln and Dry-House Scum and of Efflorescence on Face-Brick Walls, by L. A. Palmer. Bureau of Standards Technologic Paper 370. 20 cents.

Raw Materials Entering Into the Japanese Iron and Steel Industry, by J. H. Ehlers. Bureau of Foreign and Domestic Commerce Trade Information Bulletin 573. 10 cents.

Open-Hearth Investigations of the U. S. Bureau of Mines by C. H. Herty, Jr. Bureau of Mines mimeographed statement dated September 26.

A Visible-Action Continuous-Distillation Apparatus for Laboratory Study of Fractionation, by R. H. Espach. Bureau of Mines Serial 2892.

Utilization and Prevention of Molybdenum Waste in Oxidized Lead Ore Treatment, by R. E. Head and Virgil Miller. Bureau of Mines Serial 2888.

A Comparison of the Acidity of Waters from Some Active and Abandoned Coal Mines, by R. D. Leitch and W. P. Yant. Bureau of Mines Serial 2895.

Volumetric and A. P. I. Gravity Changes Due to the Solution of Gas in Crude Oils, by R. Van A. Mills and R. E. Heithecker. Bureau of Mines Serial 2893.

The Production of Magnesia and Silica Crucibles in the Induction Furnace by C. N. Schuette. Bureau of Mines Serial 2896.

Are Flame Safety Lamps Suitable for Detecting Petroleum Vapors? by A. B. Hooker, W. P. Yant, and D. H. Zellers. Bureau of Mines Information Circular 6083.

Consumption of Primary or Virgin Tin in the United States, 1927, by J. B. Umhau. Bureau of Mines Information Circular 6084.

Mineral production statistics for 1927—Separate pamphlets from the Bureau of Mines on: Feldspar, by Jefferson Middleton; Potash, by A. T. Coons; Gold, Silver, Copper, Lead and Zinc in the Eastern States, by J. P. Dunlop; and Slate, by A. T. Coons. 5 cents each. Preliminary mimeographed statements on: Barite and Barium Products and Crushed Stone.

Production Statistics from 1927 Census of Manufactures in preliminary mimeographed form for: Chemical Fire Extinguishers, Ammunition and Related Products, Lime, Terra Cotta, Foundry Supplies, Sandpaper, Emery Paper, and Other Abrasive Paper and Cloth, Rubber Tires and Inner Tubes, Beet Sugar, Blacking, Stains, and Dressings, and Linoleum and Asphalted-Felt-Base Floor Covering.

American Marine Standards Committee Specifications: AMSC 41, Metallic Packing for Condenser Tubes and AMSC 36, Magnesia Molded Pipe Covering and Blocks. 5 cents each.

Specifications for Industrial Thermometers. Bureau of Standards Federal Specifications Board Specification 472a. Available in mimeographed form. Also available in printed form as Navy Department Specification 18T7f.

Abrasive specifications. Bureau of Standards Federal Specifications Board Specifications in mimeographed form as follows: 387a, Aluminum Oxide Abrasive Cloth; 388a, Emery Cloth; 386a, Garnet Paper; 385a, Flint Paper; 583, Waterproof Garnet Paper; and 582 Waterproof Artificial Abrasive Paper.

Miscellaneous specifications. Navy Department Specifications in printed form as follows: 51S26, Soda Lime; 51A6a, Sulphuric Acid for Pickling; and 17B8, Carbon Brushes and Brush Material for Electrical Machinery. Bureau of Standards Federal Specifications Board Specifications in mimeographed form as follows: 579b, Sugar and 20a, Liquid Paint Drier.

THE PLANT NOTEBOOK
an exchange for OPERATING MEN

Boiler Feed Water Treatment Advances Toward Status of Exact Science

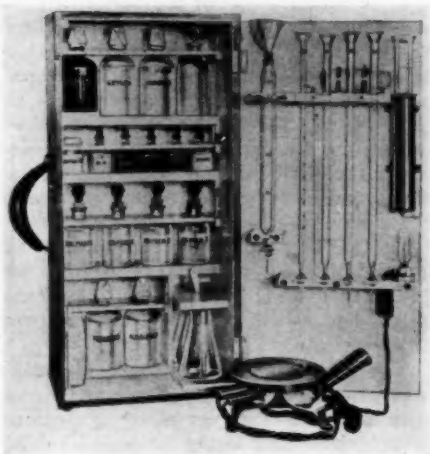
By J. A. Holmes
Director of Service
National Aluminate Corporation, Chicago

Many improvements in boiler feed water treatment have been necessary in the last few years on account of the development of higher pressures and ratings for boilers and because of the need for more economical operation. Marked advancement in both external and internal treatment has been made in methods of control as well as in improved mechanical equipment and in chemical treatment. Only within recent years has so much attention been paid to the actual condition of the water within the boiler and the possible changes that can occur.

In external treatment, the use of zeolites for waters containing a majority of sulphates and fairly low alkalinity is general. However, their use is not recommended for waters of high alkalinity with low sulphate content unless some provision is made for aftertreating to obtain correct sulphate-total alkalinity ratios.

Where lime and soda softening is used, the standard for treated water has been raised so that in cold process plants an average hardness of less than 1.0 grain per gallon is often carried with low alkalinities. This is made possible with better equipment for proportioning and mixing. The use of alkaline coagulants has also been developed for this purpose.

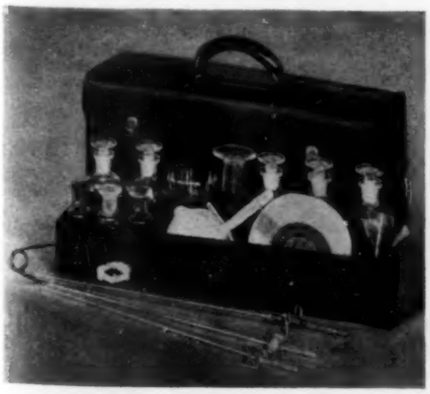
For internal treatment Hall's system has given impetus for more careful research. Parr and Straub have developed their work on embrittlement of boiler plate to the point where its cause and control is fairly well established. In addition to these theories is that of coagulation of internally treated water. The work of Koyl and Foulk indicates that foaming is based, to a certain extent, on the number and fineness of suspended particles in the boiler water. By coagulation the number is reduced and the size increased, thereby allowing a higher concentration of suspended matter.



Another Typical Portable Kit

Deconcentrators, continuous blowdown, and heat exchangers are being developed for the control of concentration. While the theory has been advanced that scale formation as well as foaming or carryover is wholly dependent on concentration, chemical treatment is usually necessary even when carrying low concentrations.

The adaption of these systems and theories requires not only definite control of the treatment but also tests and control of the water as it becomes concentrated in the boiler. Even with as nearly perfect chemically treated water as it is possible to obtain, or for that matter, make-up from evaporators, the boiler water must be checked for possible contamination or changes that may occur during evaporation. There are certain concentrations of suspended and dissolved solids which can be carried without carryover or scale formation. Such concentration for the case in point should be determined and a schedule adopted for blowdown.



Typical Travelling Engineer's Water Testing Kit

Proper ratios of sulphates to alkalinity, possible condenser or raw water leakage, oil contamination and dissolved oxygen in the feed water must be tested for and controlled. Where corrosion is prevalent, steam should be analyzed for dissolved oxygen and carbon dioxide content. Also, the return condensate should be tested for contamination by untreated water, oil or substances picked up from heating or cooking in some process.

These tests are being standardized, new methods and equipment are being developed, and definite research programs are being carried out. Every modern plant should be equipped to make complete and frequent tests in order to take advantage of these new developments and methods of control.

Boiler and feed water tests can be divided into two types—rapid and complete. The power plant engineer is more interested in rapid analysis and usually leaves the complete analysis for the chemical laboratory. While rapid analytical methods may not be as accurate, the element of time and convenience is much in their favor. Also they are better understood by the operator.

Indications of the advance in water treating are shown by the adoption of various simple tests by a large number of engineers. Soap hardness, phenolphthalein and methyl orange alkalinities, and total chlorides are easily run by straight titrations. Sulphates may be determined by the use of a sulphotometer using barium chloride to precipitate the sulphates and estimating the turbidity resulting. A more recent development for determining sodium sulphate is a system of curves permitting the use of an ultra-sensitive hydrometer. This also permits the determination of dissolved solids. Estimation of dissolved oxygen is somewhat more complicated and is based on the oxidation of a manganous solution titrating the resultant permanganate with a standard thiosulphate solution. However, the ordinary operator will find no difficulty in making this test provided reasonable care is taken with the sample. Oil is deter-

Typical Wall Cabinet for Water Testing Equipment

mined by ether or carbon tetrachloride extraction, the qualitative test usually being sufficient. For analyses of scale or suspended matter, the more complete methods of the laboratory should be followed.

The chief difficulty in the testing and chemical control of water for steam consumption has been not only in obtaining suitable solutions and apparatus, but also methods for interpreting results after they have once been obtained. Each distinct test gives some information as to the kinds and amounts of constituents in the water tested. With a complete analysis of the make-up, boiler and condensate water, all of these points learned can be assembled into an outline or picture from which the condition of the boiler water can be seen. However, this outline or picture cannot be made unless some knowledge is known of interpretation of results. The relationship of each constituent in the water to possibilities for scale formation, corrosion or contaminated steam should be known. Also, vice versa, the effect of scale formation corrosion, carryover or contamination on the chemical tests should be known.

Complete testing equipment, solutions and simple directions for use are supplied by reputable water treating chemical manufacturers and a few of the latter maintain service departments through which close check-ups are made free of charge on the plants of all users of their chemicals or treating systems. The adoption of such a system of treatment and control has without exception shown a marked improvement in boiler plant operation and has always proven a most profitable investment.

Oil in Process Steam

Chemical plants, particularly the smaller ones, frequently utilize the exhaust from reciprocating engines for direct process steam. In these cases it is usually important that the oil carried away by the steam from the cylinder walls should be as completely removed from the steam as possible. While an oil separator is usually found to accomplish this in a satisfactory manner, *Power* points out that it occasionally appears that the oil exists as an emulsion in the steam and is very difficult to remove. The difficulty may usually be solved by a change in the type of oil. It is found that compounded oils may easily result in emulsion while the oil carried away from engines lubricated with straight mineral oil exists in the form of suspension which is readily susceptible to the action of a separator. Needless to say, the amount of oil used in the engine should be reduced to the minimum requirement, not only because of the greater ease with which the smaller amount is removed from the steam, but also from the standpoint of engine economy. Mechanical lubricators assist in gaining this ideal result.

Accurate Measurement of Liquid in Tanks

By J. M. Brennan
San Francisco, Calif.

The crude and inconvenient "dip rod" can be economically replaced by simple pneumatic liquid measurement instruments in many cases. Such devices utilize the pressure head of a liquid in a container and of course do not measure the actual depth of the liquid. Readings, however, give an accurate measure of the depth when the instrument is calibrated for a liquid of the same specific gravity as that for which it is to be used. As the head of a given quantity of liquid is independent of the variation in volume due to temperature, no temperature correction need be made when such instruments are used for indicating the depth of liquid in a tank. The indicating scale may be calibrated for both depth and quantity measurements when the tank is of reasonably uniform cross-section.

The principle of pressure head measuring devices is easily explained. An open-end tube is immersed to the bottom of a vessel containing a liquid. The other end of the tube is connected to a manometer, or other pressure indicator. Air is introduced to completely fill the tube and balance the pressure head, whereupon the column of liquid in the manometer immediately rises to a height exactly equal to the depth of the liquid in the vessel, provided liquids of equal densities are used; or the manometer shows a proportional height if the specific gravities vary.

In the operation of such instruments, it is essential that provision be made for pumping air through the tube to compensate for air loss. Besides, the small volume of air retained must be hermetically sealed in the line tube to effect a correct reading. By permanently maintaining this air column between the measuring instrument and the tank measured, direct liquid connection with the instrument is avoided.

The introduction of air and the maintenance of a leak-proof air seal has presented considerable difficulty in instruments of this type. The apparatus to be described precludes the use of the ordinary air pump, with its various easily deranged parts. At the same time, it meets that important requirement, an absolute air seal.

The device shown in Fig. 1 consists of a pump chamber B and a seal chamber D. The requisite amount of mercury is placed in each chamber. To fill them, plug holes are so located that only the exact amount of mercury can be supplied, thus assuring the correct mercury height.

Two additional operating positions of the pump are shown diagrammatically in Fig. 2 at (a) and (b). From the top of the lower or seal chamber D, a connection is made to the air line F leading to the tank G. The glass tube E is connected to the bottom of the seal chamber and may be terminated with a cup to retain the excess mercury flowing from the seal chamber in case of excess pressure such as would occur if the air line should become plugged.

Operation of the air compressor is as follows: The bell tube A sliding in the mercury cylinder B is raised as in Fig. 2(a) until its open end is above the mercury in B. This permits air at atmospheric pressure to enter the bell. On depressing the lever the bell tube compresses the air and forces it through the central air tube C. As the end of this pipe is immersed in the mercury

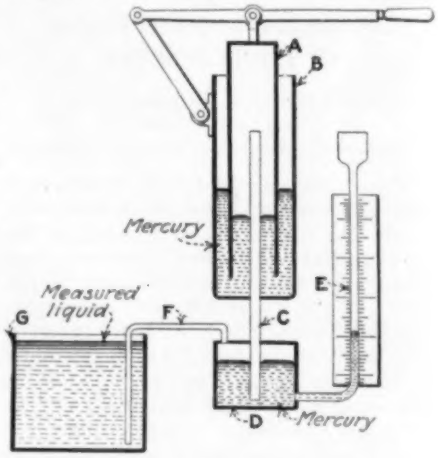


Fig. 1—Pneumatic Gage Showing Mercury Compressor, Manometer and Air Pipe

in the seal chamber D, the air must bubble through the mercury and pass through the upper part of the chamber and then on through F to the tank G, where any excess air escapes from the open end of the tube.

Repeated strokes of the compressor will deliver air only in one direction. The seal chamber, acting as a check valve, closes the lower end of C which prevents any air from returning. The

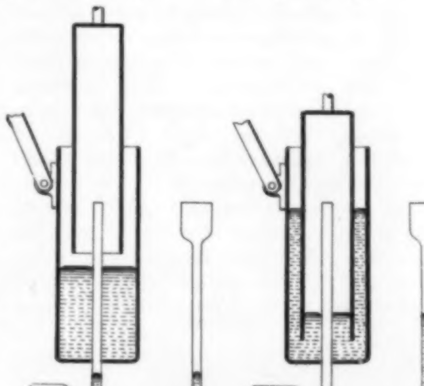


Fig. 2—Showing Action of the Mercury Compressor

At (a) the bell is withdrawn and filled with air at atmospheric pressure. At (b) the bell is lowered, forcing air into the seal chamber.

mercury then rises in the glass E and stands at a figure on the scale which is proportional to the depth of the liquid contained in the tank. Readings of 0.1 in. of mercury are easily obtained and, if a vernier scale be used, readings of 0.01 in. can be made.

A direct reading is thus obtained by means of an open-end air pipe leading from the liquid in the tank to the instrument. However, frequently it is advantageous to introduce a mercury seal between the liquid in the tank and the air pipe. This method sacrifices nothing in accuracy and is very useful where the liquid to be measured is of a viscous nature or where there is the possibility that the liquid may syphon through the air pipe. In addition, a seal also prevents clogging of the air pipe.

These mercury seals may be installed either inside the tank or externally. In all cases, they prevent any liquid from entering the small air pipe and offer the further advantages of an instantaneous reading, as well as the elimination of syphoning.

Three types are indicated in Fig. 3. The first, 3(a), consists of a saucer

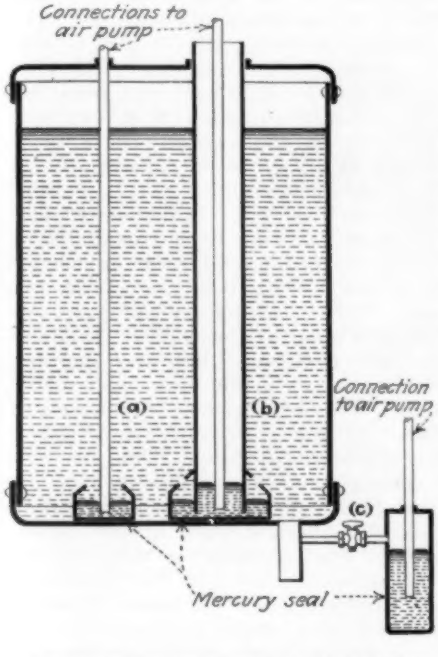


Fig. 3—Three Types of Air Line Seals
Internal seals appear at (a) and (b). An external type is shown at (c).

shaped mercury container. It is fitted to the bottom of the tank and the open end of the air pipe is secured within it. The double column type shown in Fig. 3(b) has an additional large bore tube extending upward through the top of the tank. The open end of the air tube in this case just rests upon the surface of the mercury when the tank is empty. Liquid in the tank is prevented from entering the large bore tube. The pressure of the tank liquid simply forces the mercury up this tube, automatically sealing it. The slightest movement of the mercury, however, causes an immersion of the air tube. Thus a tank reading can be made, even though the liquid may have the consistency of tar. Also air is prevented from causing any disturbance or contamination of the tank contents.

An external type of sealed connection appears in Fig. 3(c). Its operation is analogous to the seal in Fig. 3(a).

Protection Against Abrasion

It is frequently the case that the answer to some elusive problem is so simple as to be completely overlooked. One excellent example of this sort of difficulty is the one reported concerning an abrasive slurry which was discharged from a thickener pump into a launder and had a habit of abrading the launder bottom so seriously that frequent replacement was required. It was found that if a small section of the launder bottom were removed and replaced with a shallow box or pocket to retain some of the abrasive material at a point where the pump discharge struck the launder, the difficulty was entirely removed.

Prepare the Plant Now for Winter!

By Fred Emmarr
Dayton, Ohio

The season of the year is approaching when care must be exercised against the freezing of inconspicuous equipment. I have seen many industrial plants, portions of which are exposed to the weather either in skeleton buildings or actually in the open; or possibly the buildings may be covered with corrugated sheet iron with perhaps many missing sheets and openings for infiltration of the cold air.

I have in mind particularly the boiler house of a very large plant, part of which was open at the sides with only a roof to cover it, and the balance housed in sheet iron. The only heat in the building was that radiated from the boilers themselves and from a large stove about which the men would gather for warmth when not attending to their duties.

I happened to visit this plant immediately after a severe cold snap. As there had been no preparation whatsoever, Jack Frost surely collected toll. Three costly Venturi meters were bulged out, five steam flow meters burst, each of the twenty or so steam gages on the individual boilers had its Bourdon coils expanded out of shape and a number of other instruments and vital pieces of equipment had been put out of service. The operators had a difficult time keeping things going without the instruments when they did not even know what steam pressures were being maintained.

Fortunately, this is an exceptional case, but I have encountered numerous plants where winter would certainly play havoc if proper precautions were not taken in time. This is the time of year to prepare for winter. With modern weather forecasting we are warned as long as a week in advance of the approach of a severe cold wave, but it often takes more than a week to put up new sheeting, repair buildings and make other preparations. There is no time like the present for putting equipment into condition for the freezing temperatures that are on their way.

Here are a few pointers that may assist in protecting instruments and other important equipment:

1—Repair the buildings and board up or fill all openings in the walls.

2—If no other form of heat is available and the processes involved permit, have stoves or salamanders or other means for emergency heat in readiness.

3—Water lines or lines containing liquids that might freeze or be affected by the cold should be insulated to retain their heat. Still water lines should be so arranged as to have a slight flow during the cold weather, even if some of the water must be wasted. (In one plant I saw fires maintained under a series of water lines to prevent their freezing.)

4—Lines and other equipment that need not be used should be drained and allowed to stand empty until thawing temperatures return.

5—Lines to gages, especially steam and water lead lines which are without flow can be filled with kerosene or some other low freezing liquid. If the lead line is of great height some slight correction on the gage may be allowed for the difference in density between the water ordinarily used and the anti-freeze material with which it is replaced.

6—Flow meters, Venturi meters and so on can be filled with alcoholic solutions of sufficient strength to prevent freezing. The alcohol tends to become diluted gradually so that a monthly inspection may be worth while.

7—Steam gages may have their drain cocks just cracked so as to drip slightly. The condensing steam which replaces the leaking water will keep the liquid in the line warm. The drain cock should not be opened so far that the steam blows out, for a drop in pressure may exist due to the loss of the water leg and friction in the line, so that the gage will read low.

8—The two lead lines to flow meters can be arranged to lie together and a small steam line run along the two, ending in a coil around the meter proper to keep the meter from freezing. The three lines, tied together, can be insulated and the steam turned on in severe weather keeping the entire meter system warm.

If these rules are followed, if someone is kept on the job all of the time, including holidays, and if the approach of a storm is heeded there need be no trouble from cold weather sources this winter.

Ductility of Copper Welds

James Silberstein, in this department of *Chem. & Met.* for March, 1928, gave a brief discussion of the recently perfected practice of employing deoxidized copper for welded articles to avoid the brittleness encountered in use of the ordinary product. Now it is interesting to learn from the current issue of *Oxy-Acetylene Tips* that welds can be made by this method that are equal, if not actually superior in ductility, to the base metal. A chemical company used deoxidized copper for hydrofluoric acid containers. As it was necessary to know how the welds would withstand stresses, tests were made by impressing a ball into both the base metal and the weld. The former showed a crack at 6,000 lb. and the latter at 8,000 lb. pressure, indicating even greater ductility for the welded seam than for the base metal.

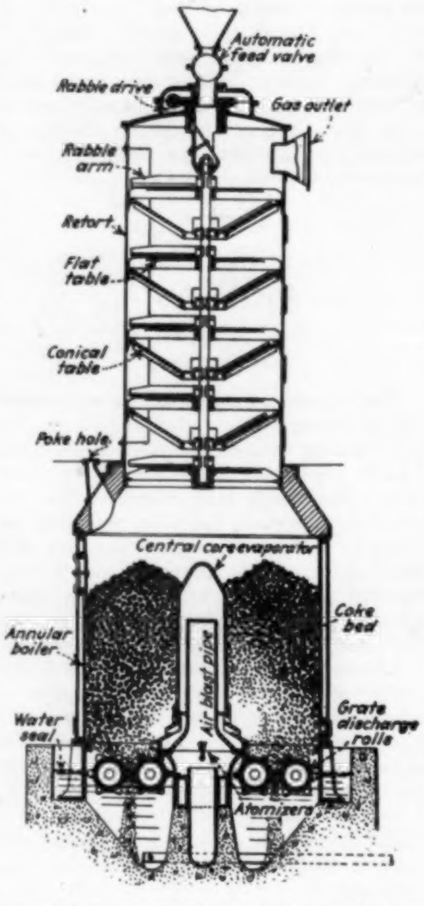
EQUIPMENT NEWS *from* MAKER *and* USER

Pre-Coking Gas Producer

Because of the more or less unfavorable fuel situation encountered in Great Britain, British engineers have, in recent years, paid a great deal of attention to the processing of coal for greater efficiency and for the more complete recovery of byproducts. While it cannot be predicted that a similar fuel situation will arise in this country for years to come, nevertheless coal processing is always a subject of much interest. One phase of the English development which is of even more immediate concern here than the strict low temperature carbonization program is the pre-coking gas producer which has been developed within very recent years by Wollaston Gas Producers, Ltd., Manchester, England. The new producer, either by itself or in combination with a furnace and boiler which burns the gas produced, possesses certain advantages which may well prove worth while to the users of gas and power in the United States.

The producer was designed and developed with a view toward greatly increasing the range of available fuels, increasing thermal efficiency, increasing the yield of ammonia and processible tars, and providing a high quality gas suitable for power, furnace and general heating requirements. It was found, in addition, that the gas resulting was considerably richer than usual, being higher in carbon monoxide and methane and lower in hydrogen and carbon dioxide than normal producer gas. The gas was found to be practically dustless, yielding a clear tar. The exit gas was, at the same time, delivered to the main at a remarkably low temperature. The producer proved capable of generating sufficient steam as a byproduct to run all of its auxiliaries, to saturate the air blast and to provide power for operating a complete recovery unit under normal conditions. In addition, it was found that clinker formation was almost unheard of and ash removal difficulties were very nearly eliminated.

The accompanying drawing shows in cross-section the usual adaptation of the pre-coking principle. Previous attempts at pre-coking within the producer or its auxiliaries had resulted in failures because, in the case of indirect heating, an uneven product resulted, and in the case of direct heating, there was difficulty with swelling of the coke. As will appear, this new producer avoids such troubles through the provision of multiple trays over which the green coal is moved in a thin layer, in contact with the hot gases from the



Pre-Coking Gas Producer Which Uses Any Coal for Its Fuel

producer for a sufficient period of time to produce a coke which reaches the producer entirely beyond the possibility of further caking. Coal is introduced at the top of the retort through an automatic feed valve which is mechanically operated and regulatable as to the rate of coal supply. A vertical shaft running through the retort and driven from its upper end by a worm and gear carries a distributor which spreads the coal evenly upon the uppermost flat tray. A rake rotating with the central shaft gradually rakes the incoming fuel to the outer edge of the tray, where it falls to the second tray which is conical. Travel of the coal during the coking period is thus back and forth across the various trays, between which it is crushed, in case the lumps are larger than is desirable, as it passes through the openings between trays.

During its coking travel through the retort, the coal is naturally subjected to a distillation period in which it gives up most of its volatile constituents as well as a considerable amount of ammonia. Having reached the lowest shelf, the coke, properly sized, is delivered in a ring upon the fuel bed in the producer proper, eliminating a considerable amount of manual labor in preserving correct coke destribution within the producer.

The producer itself is unlined and is provided with an annular jacket or boiler shell which serves the dual purpose of maintaining a low gasification temperature and providing steam for operation of the auxiliaries. About 1 to $1\frac{1}{2}$ lb. of steam at 60 lb. per sq.in. pressure is produced on the average per pound of coal gasified. An additional heat exchanging device which assists in maintaining a low fuel bed temperature is the central cone which serves as a flash boiler for evaporating and superheating the water required with the blast. Air is introduced past atomizers, picking up a mist of water which is then passed down in contact with the hot inner surface of the cast steel cone, causing evaporation and super-heating of the water. The blast is then introduced into the fuel bed through vents in the lower part of the cone. This arrangement eliminates the necessity for a separate steam source for the blast moisture. These two heat exchanging devices suffice to keep the fuel bed temperature below the fusing point of the ash even at the hottest point. The advantages of this low gasification temperature in the elimination of clinkering and the added yield of ammonia can readily be seen.

Depending upon conditions, the producer may be provided with a mechanically rotated crushing roller grate as shown in the illustration; or the grate may be omitted, using only the water lute. In view of the freedom from clinkering which is claimed, the crushing rolls are actually misnamed and serve mainly to regulate the rate of ash discharge to the lute. In smaller installations and particularly where low-ash fuels are used this mechanically operated grate is unnecessary. In larger installations and with higher ash fuels, mechanical handling of the ash is desirable and its transfer by hydraulic means is generally recognized to be the most economical practice, permitting as it does one system for ash removal from the entire installation.

As an example of the sort of gas which the pre-coking producer is capable of making, the following figures are cited. Those given for the Wollaston plant are the average of a large number of representative readings, while those for the Mond recovery plant are taken from technical papers published in England.

	Wollaston Plant	Mond Plant
CO	17.1%	11.0%
H_2	24.3	29.0
CH_4	3.9	2.0
CO_2	10.5	16.0
N_2	44.2	42.0
Total Combustible	45.3	42.0
Net Calorific Value	165.2 B.t.u.	139.7
Blast Saturation	70 deg. C.	85 deg. C.

In normal circumstances the temperature of the gases leaving the producer bed is in the neighborhood of 550 deg. C. This temperature is reduced to a point where the enriched gases leaving the gas exit at the top of the retort are as low as 250 to 300 deg. C.

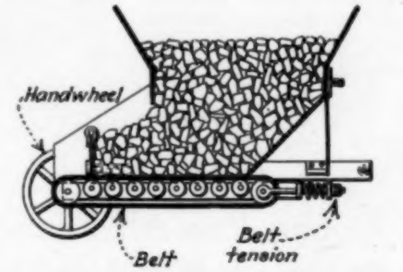
The experiences of one user of the precoking gas producer are of interest in this connection. This user found that he was unlimited as to the type of coal used, and that even under the very unfavorable conditions resulting from a producer operation period of only five hours per day, he was able to obtain a gas which averaged more than 45 per cent combustibles and 180 B.t.u. per cu.ft. He noticed that the extremely porous semi-coke which was produced by the retort, while friable, was strong enough to withstand crushing in the producer and permitted a high rate of gasification. He reported that, with a coal of 1 per cent nitrogen, he obtained from 70 to 80 lb. of ammonia per ton of coal gasified, produced in the producer portion, and about 10 lb. per ton from the retort. He found also a tar yield up to 22 gal. per ton, of a quality equal to that resulting in low temperature distillation. The tar gave a good fuel oil on distillation and a soft, almost carbon-free pitch. The retort itself he found to yield 2,000 to 3,000 cu.ft. of rich gas per ton of coal gasified. His gasification efficiency he determined from the fact that he produced 125,000 cu.ft. of gas at 180 B.t.u., per ton of coal from coal averaging 12,000 B.t.u. per lb. The efficiency calculated from these figures was found to be 83 per cent as compared with about 60 per cent for the average normal recovery plant and about 69 to 70 per cent for the usual non-recovery plant. He further noted the fact that his byproduct yield was obtained from the entire amount of coal used, whereas in the ordinary producer plant, the coal going to supply power for gasification is always burned as such together with the potential byproducts.

Pipe Thread Compound

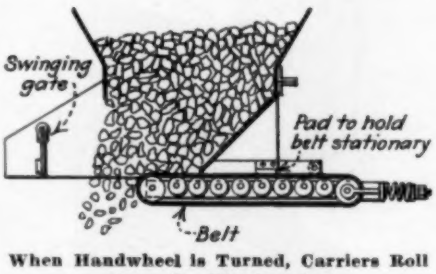
A graphite paste made for sealing screw threads, flanges and gasket joints in pipe lines carrying such materials as creosote, tar, animal, vegetable and mineral oils, and known as "Graphite Seal" has been placed upon the market by the Joseph Dixon Crucible Company, Jersey City, N. J. The new sealing material is said to expand under heat and make the joints even tighter without sacrificing ease in opening the joint in case of necessity.

Frictionless Bin Gate

A development of interest to users of overhead bins from which material must be withdrawn is the new Moore gate which is a reversal of the usual procedure in belt conveyors. The two illustrations showing the gate in the open and closed position indicate its principle of operation. A wide conveyor belt completely shuts off the opening at the bottom of the bin, but at the turn of a handwheel connected to the conveyor head pulley, the frame and rollers of the conveyor are moved back away from the opening without the usual necessity of dragging a gate plate from under the material in the bin. To close the bin, it is only necessary to turn the handwheel in the opposite direction, thus rolling the belt back beneath the opening. This development has been placed upon the market by the Stephens-Adamson Mfg. Company, Aurora, Ill.



Moore Bin Gate in Closed Position. A Belt and Rollers Carry the Load

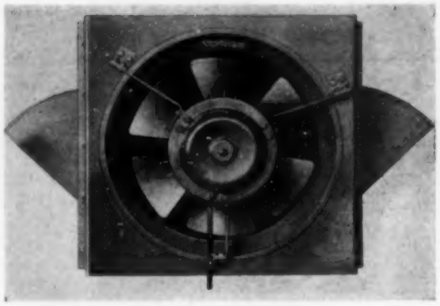


When Handwheel is Turned, Carriers Roll From the Bin Opening

Tempervane Unit Heater

In following out the recent tendencies toward the abandonment of housed centrifugal type fans for moving air against low resistances, the B. F. Sturtevant Company, Hyde Park, Boston, Mass., has developed and placed on the market a new line of unit heaters known as the "Tempervane." These heaters are made in floor, overhead, and cabinet types, in a variety of sizes and capacities to meet all requirements, and for steam pressures up to 350 lb. per sq. in.

The heating element is of the Aerofin type of extended surface tube. As this heater offers little resistance to the flow of air, it is possible to gain the advantages in power savings resulting from the use of propeller type fans. The efficiency of these fans as compared with the housed type of centrifugal fan is such that a saving of 50 per cent in electric current consumption is claimed. With the smaller motor thus necessary, the cost of the apparatus is materially reduced. One of the overhead heaters is illustrated in an accompanying view.

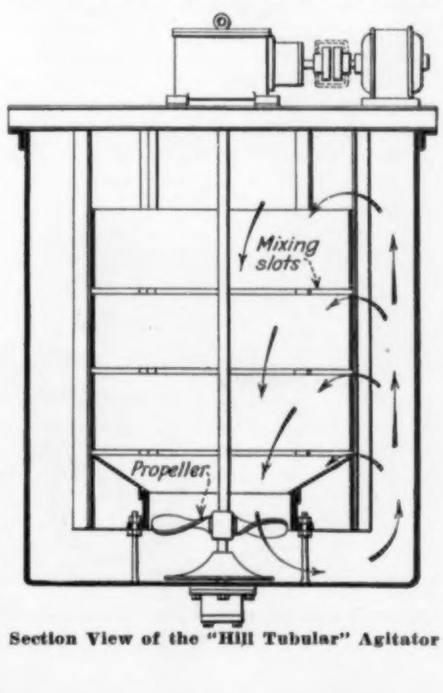


Overhead Type of Tempervane Unit Heater

Tubular Agitator

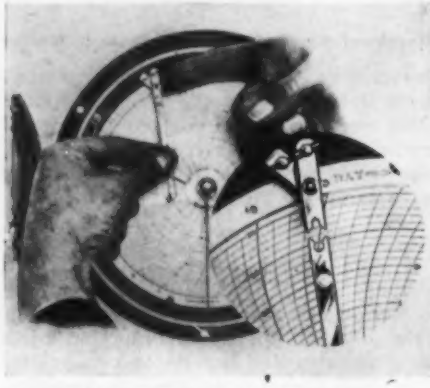
Recent work in the study of stream flow has led to the introduction of a new agitator for liquids and pastes by the Hill Clutch Machine & Foundry Company, Cleveland, Ohio. To date the system has been used for cement slurry, paint and clay wash. It is also applicable to the mixing of other liquids and suspensions. Its operation is indicated in the drawing as combining a slurry circulation down the tube, through the marine type of propeller at the bottom and up the annular space between the tube and the tank, with an intermixing of the adjacent currents of material through the slots in the tube wall. The special design of the base casting directs the flow and is said to prevent dead areas and solidification of the mixed material. It is claimed that the positive circulation induced and the thorough diffusion give perfect scouring of the bottom with high-speed mixing and low power consumption.

The tube and shaft, with the propeller, are suspended from a structural steel frame that is built over the tank. This frame carries the entire drive



Section View of the "Hill Tubular" Agitator

which may consist of any of the usual types of agitator drive mechanisms. The manufacturers state that, so long as the material settled in the tank during a shut-down does not actually solidify, there is no difficulty in starting up and obtaining a rapid mixing although there may be a considerable amount of deposited sludge in the bottom of the apparatus.



Foxboro Detachable Pen Arm

Detachable Pen Arm

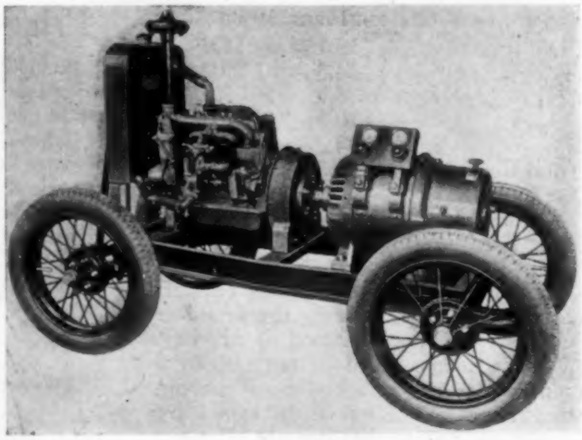
The most recent improvement in Foxboro recording instruments is a detachable pen arm with an open end. It may be quickly replaced if bent or broken, through the simple operation of detaching the arm with the finger nail, whereupon a new arm is slipped into place. This feature is shown in the illustration. The lower end of the arm is open to facilitate the removal, cleaning and inking of the pen.

Portable Pumping Unit

A new pumping unit, comprising a power source mounted together with a direct connected Amsco centrifugal pump upon a wheeled chassis, has recently been placed on the market by the American Manganese Steel Company, Chicago Heights, Ill. These units are made in three sizes, including 2-in., 2½-in. and 3-in. discharge. The first is powered with a 6 hp., the second with an 8 hp. and the third with a 10 hp. power plant, all at 1,200 r.p.m. The power plant consists in each case of a Novo engine which, however, may be changed for any other 1,200-r.p.m. power unit at option.

The 2-in. unit has a capacity of 100 gal. per min. against a 34-ft. head. The capacity of the 2½-in. unit is 150 gal. per min., and of the 3-in. unit, 230 gal. per min. against the same head. The accompanying illustration gives a clear idea of the construction of the complete unit.

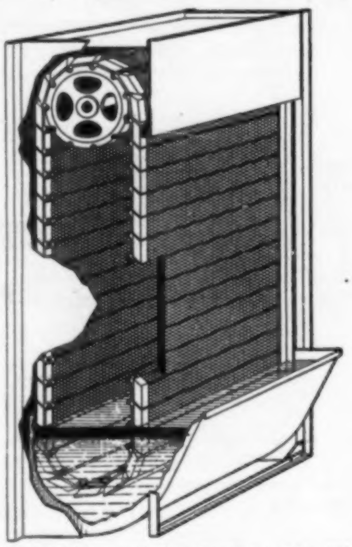
Amsco Pumping Unit Using Manganese Steel for Parts Subject to Abrasion



New "Fuzon" Portable Arc Welder

Double Pass Air Filter

The latest addition to the line of air filters put out by the National Air Filter Company of Chicago is known as the TooPas, shown in an accompanying line drawing. The drawing makes evident the construction of the filter,



Sectional View of the TooPas Air Filter

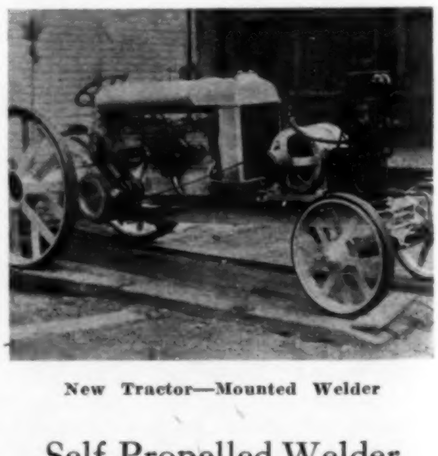
which includes a continuous belt or curtain of multiple layers of woven copper ribbon and expanded metal, passing over large supporting wheels at the top of the casing, and through an oil cleaning bath at the bottom. Unfiltered air passes through the upward moving side of the belt, giving up its dirt to the oil film carried on the filtering medium. As the velocity of the air is again lowered in passing between the two filtering portions, oil entrainment is thereby separated. A further filtering action is secured by the second wall of filtering medium which serves as a baffle to stop any stray drops of oil.

As is usual in this type of filter, the dirt removed from the air is settled out as a sludge in the oil at the bottom of the filter. The filter is provided either with motor or hand drive as the filtering medium need be turned only a short distance per week. It is said that the accumulated sludge has to be removed from the oil only once or twice per year.

Portable Welder

With the present wide-spread use of welding in the field, the portability of welders has assumed a new importance. The Fusion Welding Corporation, 103 St. and Torrence Ave., Chicago, Ill., has developed a new mobile welder which can be taken wherever a car may be driven.

The welder is powered with a Continental motor of 23 hp. for the 200 ampere, and 40 hp. for the 300 ampere set. An automatic governor keeps the motor speed constant. The "Fuzon" welder itself provides what is said to be an inherently stabilized arc and is equipped with a single brush shifting control calibrated in amperes to give an infinite number of possible current settings.



New Tractor—Mounted Welder

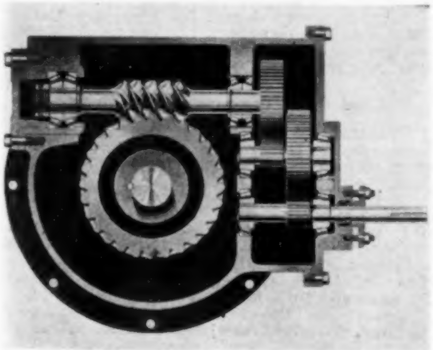
Self-Propelled Welder

An accompanying illustration shows the construction of a new mounting for the standard Lincoln Electric Company's stable arc welders, which has been announced by the Pontiac Tractor Company of Pontiac, Mich. The

welder unit with its stabilizer and panel are mounted on a frame which may be attached either to a McCormick-Deering or Fordson tractor. This gives a mobile unit, capable of hauling heavy loads in addition to its own weight. The unit may be mounted on crawlers for soft ground work.

New Agitator Drive

One of the principle difficulties in driving the agitators of kettles and tanks as well as other equipment, is to secure a noiseless drive which is, at the same time, long-lived and efficient. The New England Tank and Tower Company, Everett, Mass., has produced a new drive known as Model T-37, which it believes to accomplish



New Anti-Friction Agitator Reducer

these results. The drive is, as shown in the accompanying illustration, of rugged construction, totally enclosed, and runs in a bath of oil. It is equipped throughout with Timken bearings, and has a newly designed worm and gear. The large case has been designed to radiate heat while a positive oil trap is said to prevent any oil from running down the vertical bearings.

Indicating Flow Meter

The Meriam Company, Cleveland, Ohio, is marketing a new indicating flow meter of the orifice type, designed primarily for high line pressure of 1,000 lb. per sq.in. or greater. Pressure differentials are measured with a manometer calibrated in flow units. The meter is suggested for use with most fluids. An interesting feature of its construction lies in the fact that all joints have been welded by the new atomic hydrogen welding process. Monel metal is used for the orifice disk.

Corrosion Resisting Paint

The Paint and Varnish Division of E. I. duPont de Nemours & Company, at Wilmington, Del., has announced production of a corrosion resistant paint consisting of an emulsion of asphalt and water. As no solvents are introduced in the manufacture of the emulsion, it is claimed that the coating produced by its use possesses all of the resistance of pure asphalt.

Manufacturers' Latest Publications

Apparatus. Bethlehem Foundry & Machine Company, Bethlehem, Pa.—Bulletin 501—Descriptive of original Frederking apparatus.

Apparatus. Leeds & Northrup Company, 4901 Stenton Ave., Philadelphia, Pa. — Bulletin 434—New catalog describing a students' Kelvin bridge.

Apparatus. Schutte & Koerting Company, Philadelphia, Pa.—Publications as follows: Bulletin 5-A, low-level, multi-jet condensers; bulletin 12-G, coolers and heaters for air and gases.

Arc Welding. The Lincoln Electric Company, Cleveland, Ohio.—A supplement to this company's publication "Arc Welding, the New Age in Iron and Steel," called "How to Begin the Application of Arc Welding in Production Manufacturing."

Blowers. Connersville Blower Company, Connersville, Ind.—Bulletin 25—describing the series R-S high inertia, double-impeller blower and gas pump.

Blowers. L. J. Wing Manufacturing Company, 154 West 14th St., New York, N. Y.—A bulletin on "Improved Gas Producer Operation" through the use of the Wing turbine blower.

Boilers. Erie City Iron Works, Erie, Pa.—Publications as follows: Bulletin SB 5, concerning "Erie City" return tubular boilers; bulletin SP 4, the "Erie City Economic" boiler, a self-contained, fire tube, semi-portable boiler.

Bucket Elevators. Jeffrey Manufacturing Company, Columbus, Ohio.—Catalog 465—Handbook and catalog concerning a wide range of bucket elevators.

Building Equipment. Worthington Pump & Machinery Corp., New York, N. Y. — Bulletin WP-1003 — Concerning various types of pumps, meters, refrigeration equipment and air compressors for buildings.

Cadmium Plating. Grasselli Chemical Company, Cleveland, Ohio.—Describing the "Cadalyte" process and products for cadmium plating.

Centrifugal Pumps. The Aldrich Pump Company, Allentown, Pa. — Data 71 — Descriptions of various Aldrich multi-stage, single-suction centrifugal pumps.

Centrifugal Pumps. Dayton-Dowd Company, Quincy, Ill. — Bulletin No. 267 — Descriptive of this company's type CS and type CSLH and large capacity centrifugal pumps giving specifications, characteristics, curves and data on a large number of typical installations.

Centrifugal Pumps. Frederick Iron & Steel Co., Frederick, Md.—New bulletin regarding the company's full line of centrifugal pumps.

Chemicals. The Kalbfleisch Corporation, 200 5th Ave., New York, N. Y.—84-page catalog and book of data and tables concerning the numerous chemicals produced by this company.

Chemicals. Mathieson Alkali Works, 250 Park Ave., New York, N. Y.—A booklet called "Straight Facts About Straight Alkali."

Conveyors. Chicago Automatic Conveyor Company, 1845 So. 55th Ave., Cicero, Ill.—Folder I-77—Concerning the new Chicago Automatic belt conveyor idler.

Conveyors. Cleveland Crane and Engineering Company, Wickliff, Ohio.—Form TR-602—Concerning the easy handling of Cleveland Tramrail Carrier.

Crushers. Pennsylvania Crusher Company, Liberty Trust Bldg., Philadelphia, Pa.—Publications as follows: Bulletin 2003, describing the "Penn-Lehigh" single roll crushers; bulletin 2004, "Pennsylvania Pensteel" crusher.

Dust Handling. Research Corporation, 25 West 43rd St., New York, N. Y.—Bulletin 201—Cottrell Process for precipitation of ash and flue dust.

Electrical Equipment. Crouse - Hinds Company, Syracuse, N. Y.—Bulletin 2114—Describing the new "Obround Condulet."

Electrical Equipment. General Electric Company, Schenectady, N. Y.—Publications as follows: GEA-61B, constant-speed d.c. motors; GEA-78A, crane and hoist motors; GEA-153A, automatic switching equipment; GEA-482A, silent gears; GEA-807A, the repair of armatures; GEA-844A, CR7009-B12 magnetic reversing switches; GEA-1012, electric heating in General Electric factories; GEA-1057, type FK-12-B oil circuit breakers; GEA-1059, motor drives for twisting frames.

Evaporators. Swenson Evaporator Company, Harvey, Ill.—Bulletin S128—Describing the new Swenson forced circulation evaporator.

Gas Storage. Chicago Bridge and Iron Works, 34 West Van Buren St., Chicago, Ill.—Catalog on storing gas at high pressure in the "Hortonsphere" with data on storage and transmission.

Gas Welding. Oxweld Acetylene Company, 30 East 42nd St., New York, N. Y.—Form 462A—Catalog of equipment for cutting and welding, including generators for acetylene and floodlights.

Heat Insulation. Celite Products Company, Los Angeles, Calif.—Bulletin 102—Concerning the use of Sil-O-Cel as heat insulation in the smelting and refining of non-ferrous metals.

Metallurgy. The Merrill Company, 343 Sansome Street, San Francisco, Calif. — Handbook concerning the Merrill-Crowe process, the Mills-Crowe process, the Silver-Dorfman process and the filters made by this company.

Metals and Alloys. American Mond Nickel Company, Pittsburgh, Pa.—A new monthly publication known as the "Mond Nickel Bulletin," back numbers of which are available since July, 1928, when the first number was published. Contains a summary of timely discussions of the use of nickel together with a large number of abstracts, references and patent specifications.

Metals and Alloys. Central Alloy Steel Corporation, Massillon, Ohio.—"Nitralloy," a booklet describing the new Nitriding process for the special steel known as Nitralloy.

Metals and Alloys. Southern Manganese Steel Company, St. Louis, Mo.—A booklet on the history, composition, properties and uses of "Fahralloy."

Meters. Bailey Meter Company, Cleveland, Ohio.—Bulletin No. 35—Describing recording and integrating flow meters for measuring gas.

Meters. The Bristol Company, Waterbury, Conn.—Catalog No. 1900—Manual and catalog describing a long distance electric transmitting and recording system for use in connection with recording meters of the various kinds.

Meters. Brown Company, Wayne & Roberts Aves., Philadelphia, Pa.—A folder describing 50 places where money has been saved with flow meters.

Meters. Connersville Blower Company, Connersville, Ind.—Bulletin 4D—Descriptive of and including data on Connersville double-impeller gas meters.

Meters. Leeds & Northrup Company, 4901 Stenton Ave., Philadelphia, Pa.—A folder describing the use of push button control equipment with metered combustion control.

Mills. Harding Company, York, Pa.—Bulletin Ah152—Concerning the grinding of burned lime.

Motors. Wagner Electric Corporation, St. Louis, Mo.—Bulletin 157—Covers the present line of Wagner RA single phase motors.

Motors. U. S. Electrical Manufacturing Company, Los Angeles, Cal.—Form 485—A folder describing asbestos-protected motors.

Speed Reducers. Farrel-Birmingham Company, 344 Vulcan St., Buffalo, N. Y.—Descriptive of Farrel-Sykes roller-bearing-type speed reducers from 1 to 5,000 hp.

Stacks. Prat-Daniel Corporation, 183 Madison Avenue, New York, N. Y.—Catalog 14 — Describing various types of "Thermix" stacks with typical installations.

Thermometers. The Foxboro Company, Foxboro, Mass.—Folder DMF-528—Concerning the readability of dial type indicating thermometers.

Unit Heaters. American Blower Corporation, Detroit, Mich.—Catalog No. 7418—Bulletin completely descriptive of the new "Sirocco" unit heaters with engineering data and information.

Unit Heaters. B. F. Sturtevant Company, Hyde Park, Boston, Mass.—Catalog No. 363 — A catalog and handbook describing the types and applications of the new "Tempervane" heating unit.

Valves. The Duriron Company, Dayton, Ohio.—Bulletin 148—Describing various types of Duriron valves as well as Duriron standard flanged pipe.

Valves. Merco Nordstrom Valve Company, 343 Sansome St., San Francisco, Cal.—Catalog No. 6—A very complete catalog and reference book, 142 pages, concerning the valves, cocks, parts, accessories and lubricants made by this company.

Ventilation. E. I. du Pont de Nemours & Company, Fairfield, Conn.—Describing the auxiliary ventilation of mines as made possible by the use of du Pont "Ventube" flexible coated fabric piping.

PATENTS ISSUED

Oct. 2 to Oct. 30, 1928

Paper, Pulp, Glass and Sugar

Treatment of Sulphite-Wood-Pulp Liquor. Webster E. Byron Baker, York Haven, Pa. —1,685,800.

Paper and Pulp Screening Machine. Edward B. Fritz, Chicago, Ill.—1,685,809.

Controlling Device for Pulp-Refining Engines. Arthur J. Loman, Uncasville, Conn., assignor of one-half to William Brown, Uncasville, Conn.—1,686,217.

Paper-Making Machinery. Charles L. Henderson, Neenah, Wis., assignor to Paper Patents Company, Neenah, Wis.—1,686,322.

Recovering Sucrose from Mixtures Containing Reducing Sugars. Henry W. Dahlberg, Denver, Colo.—1,686,440.

Device for Adjustably Controlling the Location of Roller Shafts in Paper-Feeding Machines. Arthur L. Foster, Middletown, N. J., assignor to Manifold Supplies Company, Brooklyn, N. Y.—1,686,488.

Apparatus for Making Paper. Lester Kirschbraun, Chicago, Ill.—1,686,818.

Process for Cooking Wood Chips By the Alkaline Process of Pulp Manufacture. Robert Woodhead, Hopewell, Va., assignor to Venning D. Simons, Chicago, Ill.—1,687,-076.

Sugar-Spraying Apparatus. John R. Petersons, Sugar City, Idaho, assignor to Utah-Idaho Sugar Company, Salt Lake City, Utah.—1,687,178.

Paper-Making Machinery. Ralph E. Heisel, Chillicothe, Ohio, assignor to The Mead Pulp & Paper Company, Dayton, Ohio. —1,687,447.

Process for Neutralizing Cellulose-Bearing Material for Subsequent Saccharification. John Perl, Los Angeles, Calif.—1,-687,785.

Paper-Making Machine. Robert E. Read, White Plains, N. Y., assignor to International Paper Company, New York. — 1,-687,847.

Vulcanization of Rubber. Cecil John Turrell Cronshaw and William Johnson Smith Naunton, Manchester, England, assignors to British Dyestuffs Corporation Limited, Manchester, England.—1,687,861.

Cyclic Process of Using Barium Compounds in the Manufacture of Sugar. Henry W. Dahlberg, Denver, Colo.—1,688,071.

Apparatus for Treating Vulcanizable Material. Leslie Fawcett Lamplough, Chicago, Ill., assignor to Western Electric Company, Incorporated, New York. — 1,-689,206.

Paper Making. Hervey G. Cram, Millinocket, Me., assignor to Great Northern Paper Company, Millinocket, Me.—1,688,267.

Process for Simultaneously Making Sugar and Paper Pulp from Cane. Eugenio Antonio Vazquez, Habana, Cuba, assignor to Vazcane Process, Inc.—1,688,904-5.

Method of and Apparatus for Annealing Glass. Frank W. Preston, Butler, Pa.—1,689,048.

Rotary Refiner. Edmund P. Arpin, Jr., Port Edwards, Wis.—1,689,190.

Cyclic Process for the Manufacture of Kraft Pulp. George A. Richter, Berlin, N. H., assignor to Brown Company, Berlin, N. H.—1,689,534.

Stock-Regulating Mechanism for Paper-Making Machines. John Robert Spoor, Kalamazoo, Mich.—1,689,755.

Paper, Cardboard, and Pasteboard Making Machine. Otto Leonhardt, Crossen, Germany.—1,689,553.

Pulp Beater. Leonard E. Randecker, Erie, Pa., assignor to Hammermill Paper Company, Erie, Pa.—1,689,932.

Rubber, Rayon and Synthetic Plastics

Apparatus for Filtering Solutions Used in the Manufacture of Artificial Silk and the Like. William Porter Dreaper, Hempstead Heath, London, England.—1,685,775.

Treating and Wetting Out Fibrous Material. Rainer Hermann Pott, Dresden, Germany, assignor to Chemische Fabrik Pott & Co., Dresden-N., Germany.—1,686,836.

Cellulose Esters Containing Halogenated Acyl Groups and Processes of Making Same. Hans T. Clarke and Carl J. Malm, Rochester, N. Y., assignors to Eastmann Kodak Company, Rochester, N. Y.—1,687,-060.

Process of Esterifying Mercerized Cellulose with Lower Fatty Acids. Hans T. Clarke and Carl J. Malm, Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y.—1,687,059.

Manufacture of Articles of Cellulose Esters and of Their Compositions. Kevie W. Schwartz, New York, N. Y., assignor, by mesne assignments, to United Chromium, Incorporated, New York, N. Y.—1,688,060.

Method of Producing Plastic and Moldable Composition. Carl Kulas, Leipzig, Germany. Dissolved resol and comminuted rubber.—1,688,500.

Process for the Production of Thin Films of Cellulose Derivative. Arthur Eichengrün, Charlottenburg, Germany, assignor to Celanese Corporation of America.—1,688,-457.

Manufacture of Artificial Silk, Artificial Horsehair, and the Like. Henry Dreyfus, London, England.—1,688,531.

Filaments or Threads of Cellulose Derivatives and Method of Making Same. Henry Dreyfus, London, England.—1,688,532.

Process of Producing Vulcanized Rubber and Product Thereof Winfield Scott, Akron, Ohio, assignor to The Rubber Service Laboratories Co., Akron, Ohio.—1,-688,755-7.

Stabilized Latex and Process of Producing Same. Morgan Robert Day, Boston, Mass., assignor to Rubber Latex Research Corporation, Boston, Mass.—1,689,581.

Method of Spinning Artificial Filaments. Rudolf Sajitz and Friedrich Pospiech, Dresden, Germany, assignors to Chemische Fabrik Pott & Co., Dresden-N., Germany.—1,689,894.

Process of Manufacture of Cellulose Xanthate. Pierre Moro, Marseille, France. —1,689,958.

Rubber-Mixing Machine. Fernley H. Banbury, Ansonia, Conn., assignor, by mesne assignments, to Farrel-Birmingham Company, Incorporated, Ansonia, Conn.—1,689,990.

Petroleum Refining and Products

Oil-Soluble Naphthenic Compound. Oscar E. Bransky, Whiting, Ind., assignor to Standard Oil Company, Whiting, Ind.—1,681,657.

Method of Obtaining Nitrogenous Bases from Hydrocarbon Materials. Harry K. Ihrig, Martinez, Calif., assignor of one-half to Sumner E. Campbell, Associated, Calif., and one-half to Associated Oil Company, San Francisco, Calif.—1,686,136.

Removing Amorphus Wax and Asphaltic Material from Oil. Thomas Clarkson and Hammond R. Heal, Coffeyville, Kans.—1,-686,437.

Drier and the Combination Thereof with Drying Oils. Hyym E. Buc, Roselle, N. J., assignor to Standard Oil Development Company.—1,686,484-6.

Art of Obtaining Lighter Products from Hydrocarbons. Frank A. Howard, Elizabeth, N. J., assignor to Standard Oil Development Company.—1,686,490.

Preparation of Fuel Oil. Wayne S. Hughes and James Harrop, Baytown, Tex., assignors to Standard Oil Development.—1,686,491.

Refining Oils, Etc. Warren K. Lewis, Newton, Mass., assignor to Standard Oil Development Company.—1,686,493.

Method for Treating Hydrocarbon Oils. Carbon P. Dubbs, Wilmette, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,686,654.

Process for Resolving Emulsions of Tar or Oil. Herbert William Robinson, Birmingham, and Deric Parkes, West Bromwich, England.—1,687,314.

Process of and Apparatus for Treating Shale and the Lake. William Huntley Hampton, New York, N. Y.—1,687,763.

Production of Higher - Boiling - Point Hydrocarbons from Low-Boiling Hydrocarbons and Hydrocarbon Gases. Alexander S. Ramage, Detroit, Mich., assignor, by mesne assignments, to Gyro Process Corporation.—1,687,890.

Refining of Hydrocarbon Oils. Ernest B. Phillips, East Chicago, and James G. Stafford, Hammond, Ind., assignors, by mesne assignments, to The Gray Processes Corporation, Newark, N. J.—1,687,992.

Art of Cracking Hydrocarbons. John E. Bell, deceased, Brooklyn, N. Y., by Lola R. Bell, executrix, Brooklyn, N. Y., assignor to Sinclair Refining Company, New York, N. Y.—1,688,325.

Pressure-Feeding Apparatus. Lyman C. Huff, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,-688,812.

Process of Cracking Oil. Robert T. Pollock, Boston, Mass., assignor to Universal Oil Products Company, Chicago, Ill.—1,-688,830.

Process for Converting Petroleum Oils. Aubrey D. David, Chicago, Ill., assignor to The Universal Oil Products Company, Chicago, Ill.—1,688,855.

Process of Cracking Hydrocarbons. Gustav Egloff and Harry P. Benner, Chicago, Ill., assignors to Universal Oil Products Company, Chicago, Ill.—1,688,859.

Process for Cracking Oil. Gustav Egloff, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,688,860.

Process of Cracking Petroleum Oil. Gustav Egloff, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,688,861.

System for Gathering Gas from Oil Tanks., etc., of Refineries. Harry R. Maxon, Muncie, Ind.—1,689,352.

Art of Cracking Hydrocarbons. John Perl, New York, N. Y., assignor to Sinclair Refining Company, Chicago, Ill. — 1,689,-362-3.

Art of Distillation. George W. Watts, Whiting, Ind., assignor to Standard Oil Company, Whiting, Ind.—1,689,606.

Liquid-Level Control for Pressure Tanks. Edwin C. Weisgerber, Los Angeles, Calif., assignor to Petroleum Appliance Syndicate, Los Angeles, Calif.—1,689,654.

Coal Processing and Combustion

Treatment of Peat. Felix Ginsbach, Luxemburg, Luxemburg, assignor to Heinrich Horst, Berlin-Charlottenburg, Germany.—1,686,807.

Method and Apparatus for Handling Bituminous Materials. Johan Gustaf Gröndal, Djursholm, Sweden.—1,687,760.

Regenerative Channel Oven. Heinrich Koppers, Essen-Ruhr, Germany, assignor to The Koppers Development Corporation, Pittsburgh, Pa.—1,687,774.

Retort for the Distillation of Coal and Similar Carbonaceous Substances. Charles Henry Parker, Codsall, England.—1,687,989.

Distillation of Coal and Similar Carbonaceous Substances. Charles Henry Parker, Codsall, England.—1,687,990.

Distillation of Coal and Similar Carbonaceous Substances. Charles Henry Parker, Codsall, England.—1,687,991.

Air-Cooled Furnace-Wall Construction. Lyle Stockton Abbott, Chicago, Ill.—1,-688,321.

Apparatus for the Distillation of Coal and Similar Carbonaceous Substances. Charles Henry Parker, Codsall, England.—1,689,152.

Gas-Producing Apparatus. Wilbur L. Shepard, West Hartford, Conn., assignor of one-half to Edward A. Beals, West Hartford, Conn.—1,689,159.

Process of Making Fuel Gas. Adfred H. White, Ann Arbor, Mich.—1,689,940.

Organic Processes

Cyano Nitrate Explosive and Process of Producing the Same. Frank H. Bergeim, Woodbury, N. J., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del. —1,685,771.

Process of Dyeing and Printing and Product Obtained Therein. Martin Battlegay, Mulhouse, France, assignor to Calco Chemical Co., Boundbrook, N. J.—1,686,224.

Diethylene Glycol Dinitrate and Process of Preparing Same. William H. Rinkenbach, Dover N. J., assignor of one-half to Walter O. Snelling, Allentown, Pa.—1,686,-344.

Process for Obtaining Alkaloids. Georg Wilhelm Friedrich Franz Knoth, Hamburg, Germany.—1,686,866.

Purification of Benzoic Acid and Its Derivatives. Alphons O. Jaeger, Crafton, Pa., assignor to The Selden Company, Pittsburgh, Pa.—1,686,913.

Process of Making Tetra-Nitro-Dianthrone. Berthold Stein, Elberfeld, Germany, assignor to Grasselli Dyestuff Corporation, New York, N. Y.—1,686,992.

Process of Manufacturing Acetal-Dehyde. Hugh S. Reid and Waldo C. Hovey, Shawinigan Falls, Quebec, assignors to Canadian Electro Products Company, Limited, Montreal, Quebec, Canada.—1,687,228.

Apparatus for Utilizing Impure Gases or Exhaust Gases Containing Carbon Dioxide. Friedrich Riedel, Essen, Germany, assignor to Riedel Fertilizing Process Co., Inc., Elizabeth, N. J.—1,687,229.

Process for Manufacturing Urea-Formaldehyde Condensation Products. Kurt Ripper, Vienna, Austria, assignor to Fritz Pollak, Vienna, Austria.—1,687,312.

Method of Recovering Oxalates. Guy H. Buchanan, Westfield, N. J., and George Barsky, New York, N. Y., assignors to

American Cyanamid Company, New York, N. Y.—1,687,480.

Method for the Production of Styrol from Chlor Ethyl Benzol. Omar H. Smith, New York, N. Y., assignor to The Naugatuck Chemical Company, Naugatuck, Conn.—1,687,903.

Process of Making Olefine Alcohols. Fred W. Lommen, Pittsburgh, Pa., assignor to Carbide & Carbon Chemicals Corporation.—1,688,083.

Dyestuffs of the Anthraquinone Series. Klaus Weinand, Cologne-Flittard, Germany, assignor to Grasselli Dyestuff Corporation, New York, N. Y.—1,688,256.

Process of Catalyzing the Formation of Thio-Ureas. Carl Nelson Hand and Harold P. Roberts, Nitro, W. Va., assignors to The Rubber Service Laboratories Co., Akron, Ohio.—1,688,707.

Hydrolysis of Methyl Chloride. Ralph H. McKee, New York, N. Y.—1,688,726.

Dehydration of Alcohols. Sylvan R. Merley, Dover, N. J., assignor to Doherty Research Company, New York, N. Y.—1,688,731.

Reduction of Aromatic Nitro Compounds. Paul Dieterle, Buffalo, N. Y., assignor to National Aniline & Chemical Co., Inc., New York, N. Y.—1,689,014.

Method of Producing Complex Metal Alcoholates. Hans Meerwein, Konigsberg in Prussia, Germany, assignor to Chemische Fabrik auf Actien (vorm. E. Schering), Berlin, Germany.—1,689,356.

Ester of Salicylic Acid and Pyruvic Acid. Samuel Lewis Summers, Fort Washington, Pa.—1,689,696.

Process of Producing Phthalic Anhydride. Frank A. Canon and Chester E. Andrews, Pittsburgh, Pa., assignors to The Selden Company, Pittsburgh, Pa.—1,689,860.

Process of Alkylation. Charles A. Kraus and Conrad C. Callis, Worcester, Mass., assignors to Standard Oil Development Company.—1,690,075.

Inorganic Processes

Cadmium Plating. Leon R. Westbrook, Cleveland, Ohio, assignor to The Grasselli Chemical Company, Cleveland, Ohio.—1,681,509.

Reduction of Sulphate Minerals and Briquette Therefor. James Eliot Booge and Joseph P. Koller, Wilmington, Del., assignors to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,685,772.

Method of Making Calcium Polysulphide. Charles D. Wood, Walnut Park, Calif., assignor to Los Angeles Chemical Company, Los Angeles, Calif.—1,685,895.

Separation of Alumina from Alum. George S. Tilley, Mill Valley, Calif.—1,686,112.

Process of Conducting Gaseous Catalytic Reactions and Apparatus Therefor. Roland Edgar Slade, Billingham-on-Tees, England, assignor to Atmospheric Nitrogen Corporation, New York, N. Y.—1,686,349.

Apparatus for the Production of Synthetic Ammonia. Giacomo Fauser, Novara, Italy.—1,686,371.

Process of Precipitating Heavy Metals from Ammoniacal Solutions. Carl Müller, Mannheim, and Leo Schlecht and Walter Schubardt, Ludwigshafen - on - the - Rhine, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,686,391.

Mineral Dyeing. Clarence B. White, Montclair, N. J., assignor to Vivatex Processes, Inc., Lodi, N. J.—1,686,540.

Apparatus for the Synthesis of Ammonia. Georges Claude, Paris, France, assignor, by mesne assignments, to Lazote, Inc.—1,686,799.

Process for Producing Potassium Salts and By-Products. Robert D. Pipe, Piedmont, and Ross Cummings, Berkeley, Calif.; said Cummings assignor to said Pike.—1,686,835.

Process of Making Oxy-Compounds of Phosphorus. Claude G. Miner, Berkeley, Calif., assignor to Phosphorus Hydrogen Company, New York, N. Y.—1,686,873.

Dynamite Composition. Norman G. Johnson and Camuel G. Baker, Jr., Woodbury, N. J., assignors to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,687,023.

Base Exchange Silicate and Process of Making Same. Eskel Nordell, Fort Wayne, Ind., assignor, by mesne assignment, to The Permutit Company, New York, N. Y.—1,687,036.

Purifying Brine to Be Used in Electrolytic Processes. Julius Drucker, Cologne, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,687,433.

Process of Making Silica Gel. Max Yablick, Newark, N. J.—1,687,919.

Alloy. John A. Gann, Midland, Mich, assignor to The Dow Chemical Company, Midland, Mich.—1,688,043.

Tribarium Aluminate and Process of Preparing the Same. George W. Morey, Chevy Chase, Md.—1,688,054.

Saline Tri-Sodium Phosphate and Process for Its Manufacture. Charles F. Booth and Arthur B. Gerber, Anniston, Ala., and Paul Logue, Logue, Mo.—1,688,112.

Sulphur of a High Degree of Dispersion and Process of Preparing Same. Hans Schrader, Essen-Bredeney, and Harold Schoeller, Essen, Germany.—1,688,357.

Method of Producing Phosphorus Chloride. Claude G. Miner, Berkeley, Calif.—1,688,503.

Process of Preparing Purified Phosphoric Acid. John Maxwell, Philip C. Hoffmann, and Clarence E. McCoy, Richmond, Va., assignors, by mesne assignments, to Virginia-Carolina Chemical Corporation, Richmond, Va.—1,688,822.

Process for Recovery of Potassium Chloride. Norman M. McGrane, Long Beach, Calif., assignor to International Precipitation Company, Los Angeles, Calif.—1,688,873.

Method of Preventing Decomposition of Bicarbonates in Solution. Joseph Allan Shaw, Pittsburgh, Pa., assignor to The Koppers Company, Pittsburgh, Pa.—1,689,059.

Zirconium-Treated Iron-Chromium Alloy. Frederick M. Becket, New York, N. Y., assignor to Electro Metallurgical Company.—1,689,276.

Method and Apparatus for Dehydrating Tar. Arthur W. Warner, Media, Pa.—1,689,309.

Process of Obtaining Sodium Carbonate Sulphate. Alfred W. Gauger, Tottenville, and Henry Herman Storch, New York, N. Y., assignors to Burnham Chemical Company, Reno, Nev.—1,689,526.

Process of Separating Sulphur from Other Materials. Kenneth M. Baum, San Francisco, Calif.—1,689,545.

Catalytic Apparatus for the Synthesis of Ammonia. Forrest C. Reed, San Francisco, Calif.—1,689,684.

Phosphate and Process. Ernest W. Thornton, East Orange, N. J., assignor to R. B. Davis Company, Hoboken, N. J.—1,689,697.

Process of Making Alkali-Metal Hypochlorites. Alfred Oppe, Aachen, Germany.—1,689,748.

Valve. Sven Johan Nordstrom, Saratoga, Calif., assignor to Merco Nordstrom Valve Company, San Francisco, Calif.—1,689,799.

Process for the Production of Hydrogen of Great Purity. Arthur W. Burwell, Niagara Falls, N. Y., assignor to Alox Chemical Corporation, New York, N. Y.—1,689,858.

Process of Producing Calcium Aluminate Cement. Emile Marcel Roche, Castelnaule-Lez, France, assignor to Urbain Bellony Voisin, Cetter, France.—1,689,891.

Manufacture of Ferrous Hydroxide. Emil M. Lofland, Chicago, Ill.—1,689,951.

Process for Extracting the Non-Saponifiable and Difficultly-Saponifiable Matter from Fatty Material. Joseph K. Marcus, New York, N. Y.—1,690,091.

Chemical Engineering Processes

Process of Separating Gas Mixtures. Arthur B. Ray, Flushing, N. Y., assignor to Carbide and Carbon Chemicals Corporation.—1,685,883.

Continuous Expelling and Clarifying Process and Apparatus. Fred W. Manning, Berkeley, Calif.—1,686,096.

Method and Apparatus for Mixing Solids with Liquids. Wilson Evans, Chicago, Ill., assignor, by mesne assignments to National Aluminate Corporation, Chicago, Ill.—1,686,076.

Apparatus for the Activation or Revivification of Carbon. Stanley A. W. Okell, Tyrone, Pa., and Leonard Wickenden, Flushing, N. Y., assignors to Industrial Chemical Company, New York, N. Y.—1,686,100.

Bubble Tower. Louis E. Winkler and Fred C. Koch, Wichita, Kans.—1,686,542.

Filtration of Alkaline Waters. Ralph E. Hall, Pittsburgh, Pa., assignor to John M. Hopwood, Dormont Borough, Pa.—1,686,558.

Solid Acid Material. Herbert T. Leo, Corona, Calif. *Non-deliquescent solid comprising dextrose and a normally liquid acid.*—1,686,703.

Treatment of Evaporator Water. George W. Smith, Pittsburgh, Pa., assignor to John M. Hopwood, Dormont Borough, Pa.—1,686,715.

Process of Carbonizing Woolen Fibers. Rainer Hermann Pott, Dresden, Germany, assignor to Chemische Fabrik Pott & Co., Dresden-N., Germany.—1,686,837.

Gelatinized Explosive Composition. Kenneth R. Brown, Tamaqua, Pa., assignor to Atlas Powder Company, Wilmington, Del.—1,686,952.

Process of and Composition for Bleaching. William B. Stoddard, Stamford, Conn., and Vaman R. Kokatnur, New York, N. Y., assignors to Pilot Laboratory, Inc., Arlington, N. J.—1,687,803-4.

Steam and Other Vapor Power Plant Utilizing Caustic Soda or Other Auxiliary Fluids. Ernest Koenemann, Berlin, Germany.—1,687,941.

Method of Molding. Clifton D. Pettis, New York, N. Y. *Fire clay with silica.*—1,688,350.

Process of Treating Earthy Minerals. Reed W. Hyde, Summit, N. J., assignor to Dwight & Lloyd Metallurgical Company, New York, N. Y. *Continuous calcining.*—1,688,422.

Process of Preparing Product from Acetylene-Plant Waste and the Like. Douglas M. Harrison, Dormont, Pa., assignor, by mesne assignments, to McKenzie Mortar Company, Pittsburgh, Pa.—1,688,542.

Process for Heating Liquids by Electrical Energy. Gustav Baum, Karnten, Austria, assignor to The Niagara Electro Chemical Company, Inc., New York, N. Y.—1,688,679.

Art of Cement Manufacture. Walter A. Schmidt, Los Angeles, Calif., assignor to International Precipitation Company, Los Angeles, Calif.—1,688,882.

Water Softening. Paul E. Leiss, Youngstown, Ohio.—1,689,036.

Process of Drying Ceramic Ware and Apparatus Therefore. Thomas H. Rhoads, Philadelphia, Pa., assignor to Proctor & Schwartz, Incorporated, Philadelphia, Pa.—1,689,082.

Means for Feeding Fluid by Intermittent Changes of fluid Pressure. Carl H. Nordell, Fort Wayne, Ind., assignor to The Permutit Company.—1,689,557.

Commercial Blasting Explosive. Ralph Austin Long, Tamaqua, Pa., assignor to Atlas Powder Company, Wilmington, Del.—1,689,674.

Apparatus and Equipment

Water-Softening Apparatus. William J. Kenney, Chicago, Ill., assignor to Zeolite Engineering Co.—1,685,816-17.

Combined Filter and Upflow Water Softener. William J. Kenney, Chicago, Ill.—1,685,818.

Causticizing Unit. William D. Mount, Lynchburg, Va.—1,685,929.

Rendering Apparatus. Michael V. Lovett, Castanea, Pa.—1,686,017.

Distance Handling of Electrodes. Martin Walther, Oslo, Norway, assignor to Det Norske Aktieselskab for Elektrokemisk Industri of Norway, Oslo, Norway.—1,686,302.

Water Still. Ernon V. Oliver, Pasadena, Calif.—1,686,418.

Self-Baking Electrode. Carl Wilhelm Söderberg, Oslo, Norway, assignor to Det Norske Aktieselskab for Elektrokemisk Industri of Norway, Oslo, Norway.—1,686,474.

Calcining Furnace. James H. Knapp, Los Angeles, Calif., assignor to Tate Jones & Company Incorporated, Pittsburgh, Pa.—1,686,565.

Filter. Walton C. Graham, Denver, Colo.—1,687,863.

Process for the Production of Clear Brine or Other Liquors. Arthur W. Allen, Berkeley, Calif.—1,687,703.

Apparatus for Contacting Fluids with Solids. Philander R. Gray, Newark, N. J., assignor to Gray Processes Corporation, Newark, N. J.—1,688,012.

Heat Interchanger. Olive E. Frank, Buffalo, N. Y., assignor to O. E. Frank Heater & Engineering Co., Inc., Buffalo, N. Y.—1,688,183.

Water-Softening Device. Joseph J. Tomkinson, Fort Wayne, Ind.—1,688,366.

Apparatus for Heating Liquids by Electrical Energy. Gustav Baum, Weissenstein-on-the-Drau, Karnten, Austria, assignor to The Niagara Electro Chemical Company, Inc., New York, N. Y.—1,688,680.

Apparatus for Ascertaining the Characteristics of Flowing Liquids. Victor Henny, Martinez, Calif., and Jean D. Seguy, Chicago, Ill., assignors to Universal Oil Products Company, Chicago, Ill.—1,688,811.

Pump. Duncan R. Falconer, Camden, N. J.—1,689,071.

Drier. Daniel H. Applegate, Jr., Red Bank, N. J., assignor, by mesne assignments, to Proctor & Schwartz, Inc., Philadelphia, Pa.—1,689,099.

Hand-Controlled Water Softener. Charles A. Stickney, Rockford, Ill., assignor to Stickney Hydraulic Co., Rockford, Ill.—1,689,308.

Stirring Mechanism. Joseph Trimby Lawrence, Jersey City, N. J., assignor to Mitchell-Rand Mfg. Co.—1,689,733.

Flow Meter. Clarence A. Dawley, Plainfield, N. J.—1,689,776.

Apparatus for Drying or Cooling Material. Alex G. Huhn, Minneapolis, Minn., assignor to A. Huhn Manufacturing Company, Minneapolis, Minn.—1,690,013.

Rotary Kiln and Furnace. John Henry Bentley, Misterton, England.—1,690,048.

Water-Distributing Means for Cooling Towers and the Like. George J. Stocker, St. Louis, Mo.; Mercantile Trust Company, St. Louis, Mo., executor of said George J. Stocker, deceased.—1,690,092.

NEWS of the Industry

Motion Picture Program for Power Show

A FEATURE of the Seventh National Exposition of Power and Mechanical Engineering, which will be held at Grand Central Palace, New York, Dec. 3-8, will be a motion picture program running through the entire week of the show. The films cover a wide field and run from one to five reels. Some of them are to be shown for the first time, the date and time of the showing to be announced later. The program to date consists of the following films: "The Age of Speed," 4 reels; "The Handling of Heat," 1 reel. This shows the use of Norton Refractories in Industry. Films by courtesy of Norton Company; "The Story of Vim Leather," 5 reels. This picture shows the Vim Products from raw to finished products and the various functions and operations through which Vim Leather passes until put into actual operation by industry. Film by courtesy E. F. Houghton & Co.

"The Manufacture of Timken Steel Roller Bearings," 2 reels illustrating the manufacture of Timken steel from the initial process through the various operations of melting, pouring, rolling, reheating, piercing, etc. "Freezing Out Fires," 1 reel. This demonstrates the effectiveness of Fyre-Freez carbonic gas as an extinguishing medium as compared with Foam or Carbon Tetrachloride. By courtesy Fyre-Freez Corp.

"Electrical Measuring Instruments," 5 reels. This film covers the principle of the operation of "Electrical Measuring Instruments," operating and the action and movement of the various parts can be seen along with the forces which operate them. This program covers voltmeters, ammeters of the permanent magnet, movable coil and movable iron types of instruments as well as voltmeters, ammeters, watt-meters of the electro-dynomometer type, power factor, frequency meters, synchroscopes and thermo instruments. By courtesy Weston Electrical Instrument Corp.

"Controlled Heat." This film shows man's control of fire and the transmission of energy in the form of heat therefrom to work for the comfort of the human animal. "The Heat Thief," a new film. These films by courtesy Hoffman Specialty Co. "Controlling Fire in the Dip Tank," 1 reel. Courtesy Walter Kidde & Co.

"Power," 3 reels, which shows the amazing growth in the use of power since it was first applied industrially about 150 years ago, traces the development of the steam engine.

"From Coal to Electricity," 2 reels. Discloses the story of the operation of electricity from coal showing the operations and the machines used to do the work.

"Conowingo," 3 reels, which shows the building of one of the important water power projects of the United States. Located on the Susquehanna River, it is, in its initial development, second only to the plants at Niagara Falls. Films by courtesy Stone & Webster Engineering Co.

Chemists and Engineers Form Association

ASSOCIATION of Consulting Chemists and Chemical Engineers, Inc., New York City, has been chartered by the secretary of state as a membership corporation without capital stock. The objects of the association are to advance the science and practice of consulting chemistry and chemical engineering, to improve the service of the profession and to assist in the dissemination of useful information to its clients, to the public and to all branches of the government, etc., and to own and operate buildings, laboratories, instruments, equipment and facilities for the members in the practice of their profession.

Dr. Hal T. Beans, Dr. Irving Hochstadter, Clarence V. Ekroth, Jerome Alexander, Albert G. Stillwell, John Morris Weiss, Albert M. Smoot, Robert Schwarz, Dr. Arthur W. Thomas, Dr. Frank C. Gephart, Charles V. Bacon are the incorporators.

Inter-Industry Distribution Subject of Survey

THE Department of Commerce on November 12 began a census of industrial purchases in Cleveland, Ohio, in an effort to ascertain the possibility of obtaining data on inter-industry distribution as part of the National Census of Distribution which has been recommended to Congress for 1930.

Announcement of the project was made November 6 by the Chief of the Division of Domestic Commerce, who stated that Cleveland was selected because of the diversity of its industries.

German-Austrian Chemical Agreement

THE agreement concluded between German and Austrian chemical producers provides for a division of European markets as follows: Austria, Hungary, Yugoslavia, Rumania, Bulgaria and Turkey to Austria, with the Czechoslovak, Polish and Western European markets to Germany, Consul R. W. Heingartner, Frankfort-on-Main, reports to the Dept. of Commerce.

The agreement concerns alum, ammonia, sodium thiosulphate chrome alum, sulphur chloride, Glauber salts, sulphurous acid salts, sodium sulphide and a number of other products. Fertilizers are expressly excepted.

The principal markets thus affected are the Yugoslav and Rumanian, in which previously the Germans and Austrians were competitors. The German negotiator is the I. G. Farbenindustrie of Frankfort, which places at the Austrians' disposition its selling organization in the countries in question. Due to the withdrawal of the I. C. from the countries assigned to Austria, there may be a possibility for the entry into these districts of small German concerns.

Metallurgists Hold Meeting in Pittsburgh

THE SECOND annual open meeting of the Metallurgical Advisory Board of the Carnegie Institute of Technology and the U. S. Bureau of Mines was held Friday, October 10, in the Auditorium of the Bureau of Mines in Pittsburgh, Pa. T. D. Lynch, chairman of the board and a consulting metallurgical engineer for the Westinghouse Electric & Manufacturing Company presided.

Interesting reports were given by Dr. V. U. Krinobok, associate, Bureau of Metallurgical Research, Carnegie Institute of Technology, Dr. F. N. Walters, Jr., director, Bureau of Metallurgical Research, Carnegie Institute of Technology, and Dr. C. H. Herty, Jr., physical chemist, U. S. Bureau of Mines.

F. N. Speller, chief metallurgical engineer, for the National Tube Company was elected chairman of the Advisory Board for a term of three years, and G. A. Reinhardt, chief metallurgist for the Youngstown Sheet & Tube Company was elected vice-chairman.

International Merger Nickel and Steel Trade

As a preliminary to the proposed merger with the Mond Nickel Company, Ltd., the International Nickel of New Jersey took steps last month to transfer ownership of its properties to the International Nickel Company, Ltd., of Canada. The New Jersey company is a holding company, owning all of the stock of the Canadian company.

The plan which has been virtually agreed upon calls for the consolidation of International Nickel and Mond Nickel properties. It is expected that International Nickel of Canada will be the agency through which the merger will be accomplished.

It is planned to recapitalize International Nickel of Canada in such a way as to provide for the exchange of one share of its 7 per cent cumulative preferred stock for each share of 6 per cent non-cumulative preferred of the New Jersey company and six shares of no-par common of the Canadian company for each share of no-par common of the New Jersey company. The plan, from the point of view of the stockholders of the New Jersey company, will be the equivalent of a six-for-one split-up of that company's common stock. International Nickel of Canada, which will become the parent company, has agreed to make the exchanges on the foregoing basis, subject to the plan being declared operative, it is understood.

Announcement also has been made of the organization of the Krupp Nirosta Company, Inc., which will pool the patents on various kinds of alloy steel belonging to the Krupp Steel Works, of Essen, Germany, and the Ludlum Steel Company of Watervliet, N. Y.

It was announced by the Krupp representatives that an agreement had been reached with the General Electric Company by which the latter will manufacture in this country a new alloy for the drawing and cutting of metals now being manufactured by Krupp in Germany and imported into this country.

This new alloy, called "widia" by the Krupp interests and "carboloy" by the General Electric Company, has remarkable cutting qualities, it is claimed, having a hardness of 9.8 on the Mohs scale, as compared with a hardness of 10.0 for the diamond.

It is claimed that the "nirosta" steel developed by the Krupp works is not only stainless, but is also resistant to a large number of acids commonly used in industry and retains its strength to a remarkable degree at temperatures as high as 1,800 deg. F.

"The main object of the Krupp Nirosta Company, Inc.," the announcement said, "is not to act as simply a patent-holding company, but to be helpful as a service company and as a medium for the exchange of helpful ideas along that line of development. With that end in view, arrangements have been made so that the licenses of the company, including the Central Alloy Steel Corporation, of Massillon, Ohio; the Firth Steel Company, of McKeesport, Pa.; the Ludlum Steel Company and others, will have an important voice in the direction of its affairs."

Perkin Medal Awarded To Dr. E. C. Sullivan

The Perkin medal awarded annually for the most valuable work in applied chemistry will be presented this year to Dr. Eugene C. Sullivan, a leading authority on glass technology in this country. Since 1908 he has been connected with the Corning Glass Works as chief chemist, organizer and director of its research laboratory and since 1920 as vice-president in charge of manufacturing in all of its plants.

DR. E. C. SULLIVAN
1928 Perkin Medalist

The award is to be made for pioneer work in the development of scientific control and production in the glass industry, particularly for the combined research and development over a period of years which culminated in 1915 in Pyrex, the first glass of very low expansion and high chemical stability. Other of Dr. Sullivan's achievements include the production of highly uniform glass for machine manufacture of incandescent lamps, the successful development of transparent, heat-resisting glasses, railway signal applications and the evolution of an extensive series of colored glasses having unique transmission values.

Carbon and Hydrogen Made from Acetylene

A method for the production of chemically pure carbon and hydrogen from acetylene has been perfected in Germany and is being used in a plant near Berlin. Acetylene is compressed to five atmospheres in wrought iron pipes. On electric ignition, rapid dissociation takes place during which the pressure jumps to fifty atmospheres, a source of accidents during the experimental stages. Only the purest acetylene, free from oxygen, may be used in the process. The carbon produced is finely-divided and is known as "Philburgin."

A.I.Ch.E. Will Meet in New York

The American Institute of Chemical Engineers, varying its usual procedure this year, will hold its annual business meeting at the Chemists' Club in New York City at 10 a.m. on Monday, December 3. Announcement will be made at that time of the result of the election of officers for next year. No extended technical sessions are planned in view of the Institute's recent joint meeting and industrial tour with the Institution of Chemical Engineers of Great Britain.

German Dye Trust Buys Into British Rayon Company

The German Dye Trust has announced that it has acquired minority shares of British Breda Silk Limited, London, according to the Department of Commerce. The German I.G. thus directly ties up with a foreign producer of rayon, in which the I.G. itself has become more or less considerably specialized in recent years. It associates the I.G. with an enterprise that is independent of the international rayon trust composed of Courtaulds-Vereinigte Glanzstoff-Snia Viscose, although the I.G. operates partly in conjunction with the latter.

British Breda Silk Company is a subsidiary of the Netherlands rayon industry in Breda. It was registered in July with a nominal capital foundation of 1,000,000 pounds sterling, of which 650,000 pounds were to be issued, 250,000 pounds being taken by the International Viscose Company, holding company of Breda, and 100,000 pounds to the Belgian Consortium Industrielle de la Soie in Brussels, owning Breda patents.

Netherlands Breda is interested in Soie de Valenciennes, thus making the new combination inclusive of some French interests.

Experiment Station Tests Mineral Pigments

The northwestern experiment station of the U. S. Bureau of Mines, Seattle, Wash., has recently completed extensive tests of ochres and mineral pigments of the northwest in co-operation with the University of Washington. The work consisted in preparation of raw materials to secure satisfactory pigments and studies of the properties of the pigments thus obtained as compared with those in commercial use. These activities are now being extended to a survey of ochres and similar pigments of the entire United States. Methods of preparation will be given particular attention for deposits large enough to have possibilities of development.

NEWS FROM WASHINGTON

By Paul Wooton
Washington Correspondent of Chem. & Met.

REPUBLICAN SUCCESS at the polls insures a revision of the tariff. Congress undoubtedly will be convened in extraordinary session for that and other purposes in April. The proposal of the Democratic party was to revise the tariff gradually so as to avoid as much uncertainty as possible while the item was under consideration. The Republican plan apparently is to undertake at one time the entire task of remodeling the law. It is believed that this is the only way that compensatory duties and a proper relationship of rates can be worked out successfully. The remarkable progress of the chemical industry will raise many problems which must be dealt with in the new law. Many new commodities have come on the market since 1922 and the relative importance of others has changed greatly. As it is impracticable to attempt to mention every chemical commodity, it is apparent that much more careful attention will have to be given to the basket clause in the revised bill.

Republican leaders state that every effort will be made to disturb the existing rates as little as possible. At the same time, it is recognized that certain rates are too high and that others are too low. In some cases duties are provided on commodities being exported in large volume. On the other hand, a large part of the total consumption of certain commodities is being imported. In a number of these cases a slight change in the rate of duty would equalize the difference in foreign and domestic costs.

DOUBT is expressed, for instance by some members of Congress, as to the advisability of continuing the duty on ammonium sulphate. Exports are far greater than imports. The price in the United States is below the world price level. Leuna saltpeter was not produced commercially when the 1922 law was enacted. In 1926, however, imports of that commodity exceeded 100,000,000 lb. Although both ammonium sulphate and ammonium nitrate are dutiable, this product comes in free of duty. In 1922 urea was used only for chemical purposes and was given a duty of 35 per cent. Since it has come to be produced on a commercial scale as a concentrated nitrogenous fertilizer, and while there is no commercial production of fertilizer urea in this country, the 35 per cent duty stands.

The duty on argols is certain to be attacked as there is practically no domestic industry. Another example on which reduction is likely to be urged is olive oil. The domestic production is declining under the present duty and amounts to only two per cent of consumption.

Paragraph five of the tariff act is the big basket clause of the chemical schedule. It contains a large variety of products which are now of commercial importance. Sodium silico fluoride and diethyl barbituric acid are examples. In this connection it is contended that paragraph twenty-eight of the dye schedule offers excess protection for such products as indigo and sulphur black and some of the alkalis which have been exported in large quantities. On the other hand, the domestic industry is encountering sharp competition from many imported high priced dyes, and from a variety of specialties. Of all the chemicals imported about 70 per cent, on the basis of value, are coming in free of duty.

It is regarded as imperative for the dye industry to retain the American selling price basis for the assessment of the ad valorem duties. In addition, many non-chemical industries are indicating a desire to have American valuation extended to their schedules. In the revision of the act it also is regarded as of highest importance to retain the principal administrative features of the present law. These have been tested in the courts and are now on an established basis. Sight is frequently lost of the importance of the administrative provisions of the act and of the thoroughness and effectiveness with which it is administered. These factors are really as important as the rates themselves.

ANTICIPATING the early revision of the law, the Tariff Commission has been working actively on its studies of the more important commodities on which Congress is certain to request information. Investigations under the flexible provisions of the law have been helpful in that connection, in that a large variety of basic information has been collected.

The Tariff Commission will begin its linseed oil hearings December 5. Domestic costs have been obtained for 1925 and 1926. The costs of the principal crushers in Great Britain also have been secured. Information in regard to the costs of distribution for both domestic and foreign oil is unusually complete. The original report on linseed oil was returned to the Commission by the President, who asked that further information be gathered. It recommended that a decrease be authorized in the present duty.

It is expected that the Commission soon will forward final reports to the President on glue, whiting, tartaric acid, cream of tartar and edible gelatine.

Domestic field work on decolorizing carbons has been completed. In the near future it is believed that fertilizer cost data will have been made available.

In connection with its investigation of sodium phosphate under the flexible clause of the tariff act the Federal Trade Commission will conduct a public hearing in Washington on December 18. Publication has been made of the information gathered which shows that there is a difference of three-fourths of one cent per pound in favor of the German product, including transportation charges, as compared with the product of disodium phosphate manufacturers in this country. Practically the same differential exists in the case of trisodium phosphate. The present duty is one-half of one cent per pound. This is double the rate of the Underwood act.

IMPROVED methods for the manufacture of urea will make it possible to produce at a low cost, according to preliminary results obtained by H. J. Krase at the Fixed Nitrogen Research Laboratory of the Bureau of Chemistry and Soils. The laboratory has built and is testing a small scale synthetic plant capable of producing 175 lb. per day for the purpose of improving upon the process developed and used at Oppau, Germany. This process was devised to operate in conjunction with the Haber-Bosch ammonia process, using waste carbon dioxide from the coincident production of hydrogen which is combined with ammonia to form ammonium carbamate which is in turn converted into urea.

The investigations, now nearing completion, will furnish the mechanical and chemical data necessary for the design of commercial plants. Urea, being 46 per cent nitrogen or 57 per cent ammonia, is the richest nitrogen carrier known. It can be used directly as a fertilizer or can be treated with formaldehyde to produce a synthetic resin similar to bakelite. This resin posseses the advantage of transparency. It can be made clear as glass.

THE chief aim of the experiments has been to develop technique in pumping liquid ammonia and carbon dioxide and to solve chemical problems connected with the conversion of ammonium carbamate to urea. In addition, means have been found to remove synthetic ammonia gases from the carbon dioxide at atmospheric pressure, an improvement in plant efficiency. Further studies will be made in connection with mixing urea and super phosphate for fertilizers. This mixture acts as a deliquescent and becomes wet, a disadvantage which must, if possible, be eliminated.

A number of Belgian companies are sharing in a project to recover byproducts, principally sulphuric acid, from roasting sphalerite or blende. The new company being formed for this purpose at a capitalization of 30,000,000 francs is to be located at Willebroek.

Sulphuric Acid Production in France on the Increase

Expanding Manufacture of Sulphate of Ammonia and Rayon Broaden Demand for Acid

From our Paris correspondent

INDUSTRIAL circles in France are following with keen interest the expansion which is taking place in production and consumption of sulphuric acid. The fertilizer industry, especially the superphosphate branch, is by far the largest consumer of sulphuric acid and absorbs about three-quarters of the French production. The growing manufacture of sulphate of ammonia is one of the factors which has contributed in enlarging the outlet for acid. In 1927 consumption of sulphuric acid by producers of sulphate of ammonia was about 135,000 tons.

The rise in rayon production is another reason for the increased demand for sulphuric acid. In manufacturing viscose rayon, about 4 kilos of 59-60 deg. acid are required to produce 1 kilo of rayon. On this basis, the rayon industry of France is now consuming from 40,000 tons to 50,000 tons of acid annually.

Pickling of metals also offers a broad market for sulphuric acid. Most of the steel works which are pickling with or without "slowers" recover sulphate of iron by the evaporation of the waste liquors, either by direct concentration or by the Charpy process. The sulphate of iron is used in making disinfectants and weed destroyers. Sulphuric acid is often used in place of sulphate of iron.

Mixtures of varying concentrations of sulphuric acid are used as weed killers, for instance a 12-14 per cent mixture is preferred for weeding out winter corn or rye whereas a 8-10 per cent mixture will be strong enough to weed out spring cereals. The amount of mixture to be spread also varies from 80 to 150 litres per square hectare. As the cereal crops of France cover more than 9,000,000 hectares, the potential field for weed killers is very large. The Etablissements Kuhlmann have started the manufacture of phosphate of ammonia and the following patents have been taken out recently by that company: French patent No. 630,120 covers the production of phosphorus; patent No. 635,432 deals with the combustion of phosphorous vapors by steam which gives phosphoric acid, yielding hydrogen as a by-product; and patent No. 635,765 describes the condensation of phosphoric acid combined with ammonia to yield phosphate of ammonia.

PRODUCTION of minium of aluminum in France was started in 1912. Among the chief manufacturers of that color are the Société des Alumines de Provence with its Villecroze works and the Etablissements Rousseau at Tour-sur-Orbe near Bédarieux. This color is made from bauxite which is found in large quantities in the south of France. The bauxite lays are chosen according to the chemical qualities required in the finished product, they must also have qualities from the physicist's point of view.

After being extracted bauxite is dehydrated in special ovens and ground. It is then by the use of classifying and selected apparatus ground to the required fineness. Minium of aluminum is a red brown powder which mixed and ground with oil has a similar aspect to "terre de Sienne." This mixture contains about 25 per cent of oxide of iron, 3 per cent of oxide if titanium and 2 per cent of silica, with a loss of 10 per cent due to calcination. With 1 kilo of minium of aluminum 26 square meters may be covered whereas only 14 square meters may be covered by the same quantity of minium of iron and only 11 square meters by a kilo of minium of lead. Minium of aluminum was specially made to compete with minium of lead, and is already widely used in the French Railway Companies. According to reports the French works can produce about 2,500 tons of this mineral color.

Another minium, called minium of titanium is also made by the Société Française du Titane which has a working capital of 5 million francs and recently bought the Compagnie Française du Titane. The Société Française du Titane uses the Carteret and Devereux process (French patents 543,234 and 544,837). The latter process consists in treating of minerals of titanium by a mixture of oxide of carbon and chloride. By an appropriate selection chloride of titanium without chloride of iron is obtained; it is then hydrolized by a patented process (Fr. patent No. 556,-233). Titanium white is thus obtained with an eventual recovery of hydrochloric acid. This process is not as simple as the one used in the Fabriques de Produits Chimiques de Thann and other French works which consists in the treatment of ilmenite by sulphuric acid.

Resin Consortium Formed in Spain

BY ROYAL decree, a resin consortium has been created in Spain, according to the Department of Commerce. The consortium is composed of a Union made up of proprietors of resinous woods and a Syndicate of manufacturers of resinous products.

The declared purpose of the consortium is for the more scientific utilization of the pines and the industrial and commercial exploitation of resinous products. It will be directed by a council of administration, consisting of five representatives of the Union of proprietors, five representatives of the Syndicate of manufacturers and three representatives of the state, chosen by the Ministerio de Fomento, one of whom will act as president.

The Union proprietors of woods includes provinces, municipalities and individual proprietors of woods. The syndicate will be composed of naval stores manufacturers who have been matriculated as such for at least a year prior to the date of the decree and are of Spanish nationality. Foreign firms desiring to associate themselves with the Syndicate must take steps for their nationalization.

duPont-Grasselli Companies in Merger

AGREEMENT was reached on November 10 whereby the Grasselli Chemical Company will be merged with the E. I. du Pont de Nemours Company. The agreement was ratified after the Department of Justice had ruled that the proposed merger was not in violation of the anti-trust laws. In a statement issued in the latter part of October, by T. S. Grasselli, it was stated:

"An agreement has been entered into between the E. I. du Pont de Nemours & Co. and the Grasselli Chemical Co., having as its object a consolidation of the interests of the two companies.

"This agreement, if approved by the stockholders of the Grasselli company at a meeting to be called for November 10, provides for the retirement of Grasselli's 6 per cent preferred stock on December 31, 1928, at $110 per share, plus accumulated dividends to December 31, 1928. The Grasselli company will receive for subsequent distribution to its common shareholders common shares without par value of the du Pont company in numbers equal to one-fifth of the number of Grasselli's outstanding common shares without par value.

"It is further understood that the combined heavy chemical business of the two companies will be carried on under the long established name of the Grasselli Chemical Co. and that no important changes are contemplated in the present efficient administration of these activities. The interest in the Grasselli Dyestuff Corporation and other affiliated dye interests heretofore owned by the Grasselli Chemical Co. have been disposed of by the Grasselli Chemical Co., and are, therefore, not included in the consolidation.

"It is believed that the advantages to be gained from the combined technical knowledge and experience of these two great companies will result in the more rapid development of the science of chemistry and its application to the industries of this country and that greater economies will be assured in the manufacture, sale and distribution of chemical products. It is hoped that the reorganization may be completed on or before the close of the year."

Technical Subjects Featured Annual Convention of German Scientists

Interesting Reports of Developments in Wide Range of Research Work

From Our Berlin Correspondent

ONE OF THE several interesting technical subjects discussed at the 90th annual convention of scientific and medical men at Hamburg in September was the peculiar phenomenon of superconductance, i.e. the property of some metals to lose practically all electric resistance when at a temperature near absolute zero. This was the subject of a paper by Dr. Meissner, of the National Physico-technical Institute, who found this peculiar state to commence at 44 deg. abs. C. in the case of tantalum,—in other words slightly above the boiling point of liquid helium. At this same temperature Professor Keesom, Leyden, investigated the specific heat of lead and Dr. Simon, Berlin, the specific heats of iron and copper.

Of potential practical interest was the report on the extraction of vanillin from sulphite liquors by K. Kurschner, Brunn. From the waste liquors of a cellulose plant he has succeeded in obtaining considerable quantities of the aromatic compound, developing at the same time a new gravimetric method for the rapid determination of vanillin.

The technical use of fluorine, in the form of BF_3 was discussed in these columns in the July issue. On the theoretical side, a new contribution has been made by Professor Ruff, Breslau, in the form of NF_3 and ClF. Commercial application is now to be awaited.

SLIPPERINESS of city streets constitutes a dangerous factor for which some remedy would come as a boon. In this connection Professor Kindscher and Dr. O. Schöneberg, of the National Testing Materials Bureau, have made a chemical investigation of dirt accumulation on the asphalt pavements in Berlin. Automobile exhaust gases gave this material its predominant smell. It was found to contain 9 to 10 per cent of mineral oil, all due to automobile traffic. This oil is held to be principally responsible for the slipperiness of city streets and the consequent accidents of all kinds. The question arose, whether or not tar pavement were to be preferred to asphalt. At present the controversy on this matter has not abated; meanwhile, simple washing of streets is not adequate in view of the hard water and it is up to engineers to solve the problem of a proper alkaline treatment.

Franz Fisher has worked on the synthesis of benzene hydrocarbons from methane at normal pressure and without catalysts. His conclusion is that considerable quantities of aromatic hydrocarbons may be generated if careful control is exercised on the rate of flow (i.e., time of heating), the proper reaction temperatures, and the correct cooling rate, so that methane can be used for benzene synthesis wherever economic conditions and plant installation make it feasible.

Barium carbide, according to further reports of Franz Fischer, can be easily obtained from oxygen compounds of barium at convenient temperatures such as are generated in normal gas installations (1050 to 1200 deg. C). Particularly high yields (over 60 per cent) were obtained by using methane in the combustion, at a pressure of 12 to 18 mm. The carbide produced at low temperatures reacts with water to form not only acetylene but also hydrogen.

The process of "tar-coking" will prospectively cause a great demand for coal tar. In the Ruhr district a coking plant for tar is being equipped with 25 ovens. Tar coke, like petroleum coke, is especially employed in the manufacture of electrodes. The plant at Duisburg-Meiderich is to enter operation in December.

High test, i.e., benzol-blended, motor fuels, are finding an increasing market due to the great advances in the application of motors for general transportation and farming.

AT Heidelberg a firm called the Holzhydrolyse A.G. (Wood Hydrolysis Company) has been organized with a capital of 200,000 M. The purpose of the company is the practical exploitation of the process for converting wood, especially waste material, into carbohydrate foods, according to the method developed by Friedrich Bergius.

According to report, a new large nitrogen plant, erected in conjunction with the Klockner-Werke, is soon to begin production to its full capacity. The production schedule calls for the conversion of the synthesized ammonia into concentrated fertilizers by means of crude potash. A second nitrogen plant at Sonderhausen has passed the first stages of construction. The equipment will probably be installed within a month or two.

Second International Coal Conference

The second International Conference on Bituminous Coal will be held Nov. 19-24, at Carnegie Institute of Technology, Pittsburgh. The program will include papers on coal processing by leading international authorities. The meeting will be reported at length in the December issue of *Chem. & Met.*

Coal Processing Discussed By Leading Scientists

COAL processing, particularly in relation to the production of liquid products and smokeless fuel, was the subject of a luncheon meeting of the American Institute of New York City, held at the Hotel Commodore of that city on Nov. 10. In a sense the meeting was a preliminary session of the Second International Bituminous Coal Conference which will be held by the Carnegie Institute of Technology in Pittsburgh, Nov. 19 to 24. The speakers included Dr. Thomas S. Baker, president of Carnegie Tech; Dr. Friederich Bergius of Heidelberg, Germany, and inventor of the Bergius process of coal liquefaction; Dr. Cecil H. Lander, director of the fuel research board of Great Britain and A. C. Fieldner, head of the experimental stations of the U. S. Bureau of Mines.

As pointed out by President Baker, it is not generally known that Dr. Bergius has long been interested and has developed a process for the conversion of cellulose into nutritive carbohydrates and alcohol. The International Sugar and Alcohol Company, in which Distillers, Ltd., of London is largely interested, has been formed to exploit the process in the same way that the International Bergin Company is handling the coal liquefaction process. Dr. Bergius began the cellulose research about 1908 when he first transformed wood into an artificial coal which he was then able to liquify by hydrogenation. This was prior to the time when he succeeded in applying the same process to natural coal. Since 1925 research on the original Bergius process has been largely in the hands of the I. G. and Dr. Bergius has turned his energies again to cellulose. At the present time he is able to prepare as much as 60 per cent of pure carbohydrate from wood pulp and can hydrolyze this to cattle feed or ferment it to yield alcohol. The process assumes economic significance in Germany because of necessity of importing cattle feedstuffs and the importance of alcohol in German chemical industry.

Dr. Lander said the war had taught England that coal was her principal asset and since that time there has been a well co-ordinated research program underway in that country. The Fuel Research Board is interlinked with and subsidizes much of the investigational work done by other British agencies. In referring to low temperature carbonization, Dr. Lander said while it was not safe to generalize by countries, or even by cities within a country, it is, however, the direction in which British research was headed.

Arno C. Fieldner addressed the meeting on the subject: "The Future of Coal in the United States." He referred particularly to the origin of the coal work of the Bureau of Mines and indicated the important trend in this country toward the utilization of coal as a chemical raw material.

News in Brief

ROSIN PRODUCERS are seeking an extension of the grading done by the Food, Drug and Insecticide Administration of the United States Department of Agriculture under the naval stores act, according to Dr. F. P. Veitch, in charge of this work, who recently returned from a trip to the naval stores producing section of the South. Several producers who have not yet availed themselves of the opportunity of having their rosin graded by the government graders informed Doctor Veitch that they intended to ask for federal grading at their plants when the new naval stores season opens in April.

A TWO-DAY MEETING of executives and the directors of the chemical sections of the industrial departments of E. I. du Pont de Nemours & Company was held at Wilmington, Del., Oct. 26-27. Dr. Charles M. A. Stine, chemical director of the du Pont company, presided over the meeting which was under the auspices of the Central Chemical Department of the company.

THE KAURI GUM CONTROL BOARD of New Zealand has applied to the government for funds in order to carry on an aggressive marketing policy against gums in foreign markets. The board has been investigating the markets in the various importing countries and has been considering the acquisition of a cleaning plant to permit the standardization of lower qualities of gum on a minimum resin content basis. The board believes that with a fair return to the producer there will be an ample supply of gum to maintain the industry for many years.

THE GERMAN DYE TRUST has put in operation its enlarged cuprammonium rayon plant at Gormagen Cologne with a capacity of 5,000 kilograms daily, according to a report to the Department of Commerce. Heretofore, the Dormagen plant operating the cuprammonium process of the I. P. Bemberg Company, at Barmen, had a capacity of but 2,000 kilos daily. The present operation is declared closely associated with Bemberg.

CONFERENCE PLANS for southern fertilizer men meeting in their annual conference at Atlanta, Nov. 13 and 14 give special attention to ethical marketing methods, promoting welfare of the fertilizer industry itself through advertising, and Muscle Shoals in its relation to the fertilizer industry. All members of the industry regardless of membership in the association were invited to attend.

THE CONSOLIDATED MINING AND SMELTING COMPANY of Canada is planning to utilize sulphur dioxide fumes from its zinc refinery at Traile, B. C., for the manufacture of sulphuric acid. The new plant which is now in process of construction will be producing by the end of the present year and will have a daily productive capacity of 35 tons of 100 per cent acid. It is the object of the company to use the sulphuric acid so produced for the manufacture of superphosphate fertilizer. Large beds of phosphate rock have been discovered by the company's engineers in the vicinity of Fernie, B. C.

Hercules Powder Advances Technical Men

BELIEVING that the company's interest would best be advanced by bringing into its membership some of the younger and experienced technical executives, the Board of Directors of the Hercules Powder Company recently elected and added to the board the following: L. N. Bent, general manager of the naval stores department; George M. Norman, technical director; C. A. Bigelow, general manager of the explosives department, and C. C. Hoopes and C. A. Higgins of the company's Finance Committee.

At the same time it was announced that A. B. Nixon, who had been superintendent at the Union· N. J., plant, had been made general manager of the cellulose products department. He is succeeded at Union by M. G. Millikin, formerly assistant superintendent, which position is now to be held by E. F. Thoenges.

In the naval stores department, C. A. Lambert, who was manager of operations in Mississippi, has been transferred to Wilmington to become director of all operations. He is succeeded as manager of naval stores operations in Mississippi by V. R. Croswell, formerly technical manager in charge of chemical control and technical research at Brunswick, Ga.

Tariff Hearing on Flaxseed Set for December 5

PRELIMINARY data on the costs of producing flaxseed in the United States and in Argentina, which will be used by the President in determining the rate of duty under the flexible tariff act, were made public on October 30 by investigators for the United States Tariff Commission.

The present duty of 40c. per bushel more than compensates for the lower Argentine production costs on seed delivered at New York, according to a method of calculation which includes all weighted average figures for a two-year period; but alternative methods of computing several of the many factors are given, which can be used to show that a 50-per cent increase in the duty is needed. The proper interpretation and application of the data is to be discussed before the commission, December 5.

Agricultural Chemists Hold Annual Convention

MORE importance should be attached to the determination of the factors contributed to plant life by the presence of the less common elements, according to resolutions adopted at the forty-fourth annual convention of the Association of Official Agricultural Chemists, held in Washington, October 29-31. While it was agreed that agricultural chemists should devote primary attention to the elements present in animal life in largest amounts, it was brought out that the development of research in analytical chemistry will expedite greatly the work of tracing the importance of the rarer elements.

The president of the Association, Dr. Oswald Schreiner, Chief of the Soil Fertility Division of the Department of Agriculture, presented a paper in which he reviewed some of the beneficial effects that copper, antimony, tin, barium, cobalt, zinc, nickel, aluminum and manganese had been found to have in stimulating plant growth. Manganese, particularly, he brought out, has been disclosed as essential to plant growth in experiments conducted in the Florida Everglades region. Dr. Schreiner also expressed the belief that the value of such elements as chromium vanadium, and titanium that are known already to exist in plants, will be determined soon by the help of the chemist.

New Standards Association Replaces Committee

UNANIMOUS approval by the thirty-seven member bodies of the establishment of the American Standards Association to succeed the American Engineering Standards Committee is announced by William J. Serrill, assistant general manager of the United Gas Improvement Company of Philadelphia. Mr. Serrill was chairman of the standards committee, and now becomes president of the American Standards Association. One of the most important results of the abandonment of the committee form of organization will be a much greater degree of participation by trade associations.

Dr. Herty Speaks at Meeting of Engineering Foundation

THE October meeting and dinner of the Engineering Foundation was held at the Union League Club, New York, on the evening of October 18. The principal address of the evening was delivered by Dr. Charles H. Herty who spoke on the subject "Cellulose." Dr. Herty outlined the broad uses of cellulose as a chemical raw material. He referred to the pine trees in southern states as a future source of supply. Ambrose Swazey, founder of Engineering Foundation, spoke briefly and Prof. Marston T. Bogert of Columbia University who was the guest of honor, addressed the gathering.

MEN in Chemical Engineering

HAROLD J. ROSE, assistant director of research for the Koppers Company, is the recipient of the Grasselli Medal for 1928. The presentation was made at the Chemists' Club, New York, at a joint meeting of three chemical societies there on November 2. Mr. Rose is a native of South Dakota and a graduate of Yankton College in that state. He joined the Koppers Company, with charge over the coal and coke division, in 1918. The medal, which is awarded annually by the American section of the Society of Chemical Industry, was presented by A. C. Fieldner of the Bureau of Mines.

J. J. MOOSMANN has been appointed assistant general manager of the paint, lacquer and chemicals department of the du Pont Company to fill the vacancy caused by the recent death of J. W. Elms. His previous position was division manager of the chemical products division at Parlin, N. J.

E. M. FLAHERTY, who was recently made assistant division manager for the du Pont Company at Parlin, N. J., has now been appointed division manager to succeed J. J. Moosmann.

F. G. LILJENROTH, chemical engineer of Stockholm, Sweden, arrived for a visit in the United States on October 10 and is making his headquarters at the Ritz-Carlton Hotel in New York.

WILLIAM F. COCHRANE, formerly chief engineer of the U. S. Industrial Alcohol Company, has been appointed assistant to the president of that organization.

WALTER F. MUNNIKHUYSEN has been appointed district engineer of The Koppers Construction Company, and will be located at the Chicago offices.

ERNEST OWEN, formerly superintendent of development and design for the Tide Water Oil Company, is now connected with E. B. Badger and Sons, Boston, in the design and construction of oil refinery equipment.

A. E. DUNSTAN, chief technologist of the Anglo-Persian Oil Company, arrived early this month on a visit to the United States. He gave a series of lectures at the Royal Society before leaving and is scheduled to hold further addresses here.

L. A. NIELSEN, who for a number of years assisted in the editorial work of *Chem. & Met.*, will now serve as Mr. Parmelee's secretary in his new duties as editorial director of the McGraw-Hill Publishing Company.

R. E. SEBASTIAN, chief of the protective division of the Chemical Warfare Service at Edgewood Arsenal since 1921, has resigned to accept a position in the development department of the Roessler and Hasslacher Chemical Company at Niagara Falls.

Photograph by Bachrach

ARTHUR A. BACKHAUS

ARTHUR A. BACKHAUS, who was production manager of the U. S. Industrial Alcohol Company, Baltimore, has been elected vice-president of that company. His election follows twelve years of service in that organization, beginning two years after he had completed his schooling. Born in South Dakota, in 1889, Dr. Backhaus attended the Universities of Rochester and Michigan until 1913.

CALENDAR

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, convention, New York City, Dec. 27, 1928-Jan. 2, 1929.

AMERICAN CERAMIC SOCIETY, 31st annual convention, together with AMERICAN CERAMIC EXPOSITION, Chicago, Feb. 4-9, 1929.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, annual meeting, New York, Dec. 6-7.

AMERICAN SOCIETY FOR STEEL TREATING, semi-annual meeting, Los Angeles, January 14-18.

INTERNATIONAL CONFERENCE ON BITUMINOUS COAL, 2nd conference. Carnegie Institute of Technology, Pittsburgh, Nov. 19-24.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING, New York, December 3-8.

WESTERN METAL CONGRESS, Los Angeles, Calif., January 14-18.

JOHN ARTHUR WILSON will give this year's Chandler Lecture at Columbia University on December 7. He will speak on "Chemistry and Leather" and will receive the annual medal provided for by the Chandler Foundation.

CHARLES H. HERTY has opened offices at 101 Park Avenue, New York, for work as industrial consultant, especially with regard to the utilization of natural resources in the South. Dr. Herty will remain connected with the Chemical Foundation, Inc., as special representative.

L. VICKROY of the Chemical Warfare Service's engineering department has now taken a position with the Champion Coated Paper Company of Hamilton, Ohio, where he will be associated with D. B. Bradner, formerly chief chemist at Edgewood Arsenal.

J. S. REICHERT, for the past four years in the defense department of the Chemical Warfare Service, has joined the staff of the Roessler and Hasslacher Chemical Company at Perth Amboy, N. J.

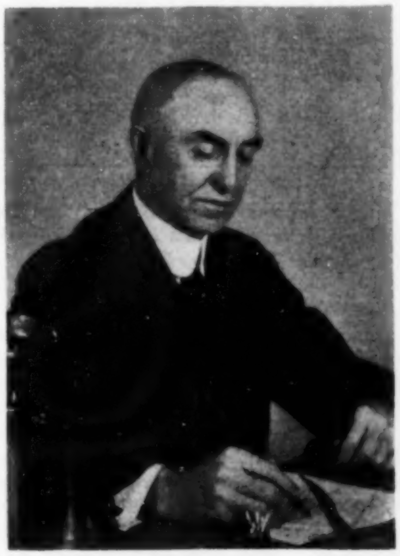
JAMES A. LEE has joined the editorial staff of *Chem. & Met.* as assistant editor. He comes from eight years of service with the Western Electric Company and Bell Telephone Laboratories, where he did work in the development of electric

JAMES A. LEE

insulation. Mr. Lee is a native of Louisiana, attended Washington & Lee University and M. I. T., and had his introduction to chemical engineering through the Chemical Warfare Service in 1918, in charge of smoke screen production. Before joining the telephone laboratories he was also with the Citizens' Gas Company at Indianapolis.

L. H. BIGGARS, formerly of the Hardinge Company and lately on the engineering staff of the City of Pasadena, Calif., is now with the Celite Company in Los Angeles engaged on work related to filtration problems, which has been his specialty for some time.

OBITUARY



JOSEPH P. DEVINE

Joseph Paul Devine, president of the J. P. Devine Manufacturing Company, died unexpectedly at his home in Buffalo on the evening of October 28. It was believed that he had passed through a recent critical illness safely and that he would again assume his activities after a brief convalescence.

Mr. Devine was born in Philadelphia in 1867, descending from prominent Quaker stock. Having begun as a young man in the ice business, he soon left for Niagara Falls, N. Y., to aid in the construction of a carbide plant there, subsequently joining the National Battery Company. In 1904 he succeeded in obtaining the Passburg patents in Germany and organized the J. P. Devine Company in Buffalo, which he headed until his death.

It was as dominant figure of this organization that he was known to his numerous friends throughout the chemical and process industries. Specializing in the field of vacuum drying, he was enabled by his keen technical sense to develop systems and installations far in advance of their apparent time; as a result he was instrumental in the progress of numerous new and immature industries. Even up to the time of his death J. P. Devine continued to exercise his unusual ability in the technology of the process industries.

Less than a year ago, for the purpose of expansion, his organization joined forces with the Mt. Vernon Car Company, forming the J. P. Devine Manufacturing Company. Strangely enough, Mr. Devine, the founder and president, died less than a month after the death of the chairman, W. C. Arthurs.

Bernard N. Glick, who was connected for the past fifteen years with the Industrial Chemical Sales Company, Inc., at New York, died on November 5. Mr. Glick was only 38 years old and had charge of the technical department of his company. His specialty was the use and application of activated carbons, on which subject he had written an article which appeared recently in *Chem. & Met.*

Thomas E. Pope, eighty years old, a former professor of chemistry at Massachusetts Institute of Technology died at Whitinsville, Mass., on October 30. He was a native of New Bedford and a graduate of Harvard College. At one time professor at Ames Agricultural College, Ames, Iowa, his term of service at Massachusetts Institute of Technology covered a period of thirty years.

James W. Elms, assistant general manager of the paint, lacquer and chemicals department of the du Pont Company, died on October 18 in Paris from the effects of an intestinal operation. Mr. Elms had left this country early in September on a business trip for his company in Europe; he was in England a few days and after he had proceeded to Paris his illness developed.

Mr. Elms was a graduate in chemical engineering from the University of Maine in 1906, having been born at Dover, Me., in 1885. Upon graduation he was employed for a time at the General Electric Company's laboratory at Lynn, Mass., before joining the du Pont Company in 1907. Until the World War he advanced steadily at the Haskell plant and was then promoted to superintendent of the Carney's Point plant. Later he played an important part in the activities at Old Hickory, then took part in the post-war salvage operations of the du Pont Chemical Company. His last position came as a result of successive promotions at Parlin and Philadelphia.

JAMES W. ELMS

James A. Smith, superintendent of the Schenectady plant of the General Electric Company, died at his home on October 25. Mr. Smith was born in 1873 at Hartford and was technically employed at various companies before joining General Electric in 1910. He became general superintendent at Schenectady in 1913.

P. Samuel Rigney, member of the board of directors of the Roessler & Hasslacher Chemical Company died suddenly of a stroke while attending a meeting of the company's board on the evening of October 23. Mr. Rigney was a native of Orange County, N. Y. where he was born in 1872. After attending the local schools he studied law at Newburg, but became connected with the chemical industry in 1918. His success there was rapid, so that at the time of his death he was not only secretary of the Roessler & Hasslacher organization but also executive of the Niagara Electro Chemical Company, Compressed Gas Manufacturers' Association, and numerous other organizations.

INDUSTRIAL NOTES

The National Lead Company, New York, has acquired the sole selling agency for the Chemical Equipment and the Samuel Smith & Son Companies, Paterson, N. J., producers of homogeneous lead and tin linings.

The Graybar Electric Company has been purchased by its employees from the Western Electric Company.

The Industrial Chemical Sales Company, Inc., 200 Fifth Avenue, New York, announces that its representative, J. P. Harris, has moved his headquarters to the Engineering Building, 205 W. Wacker Drive, Chicago.

The Boston Woven Hose & Rubber Company at a meeting of its board, shortly after the unexpected death of George E. Hall, elected J. Newton Smith president of the company. At the same meeting Arthur C. Kingston was elected a vice-president.

The Prest-O-Lite Company commenced operations in October at its new plant located at 3155 27th Ave., Birmingham, Ala.

The Dorr Company announces that A. T. Hastings, who has for several years been manager of the Los Angeles office, sailed for Europe on October 20 to join the Dorr Company, Ltd., London. A. M. Kivari succeeds Mr. Hastings.

The Prat-Daniel Corporation is now located in its new home at 183 Madison Avenue, New York.

Pfaltz & Bauer, Inc., have appointed Leonard F. Eikler manager of their fine chemical department. Lester McNerney has been transferred to California, where he has taken up the duties of vice-president and manager of the Pfaltz & Bauer Chemical Co. of Calif., Inc., 683 Antonia St., Los Angeles.

The Standard Conveyor Company announces that its representatives in New Orleans, La., are Robbins and Robbins, 1003 Magazine Street.

Huron Industries, Inc., have moved their general sales office from Alpena, Michigan, to the Builders Building, Chicago, Illinois, effective November 1. H. W. Munday has been appointed general sales manager.

The Roller-Smith Company, of New York, announces the appointment of Wise & Braisted, General Motors Building, Detroit, Mich., as its district sales agent for Michigan, and of Arthur H. Abbott, Inc., 88 Broad Street, Boston, Mass., as its district sales agent for the New England territory.

The Nugent Steel Castings Company, Chicago, has appointed H. C. Osman, heretofore secretary and in charge of sales, as works manager of the company.

The New Jersey Lacquer Company announces the removal of its plant to the new building located at 920 Dell Avenue, North Bergen, N. J.

Fairbanks, Morse and Company, Chicago, have elected T. A. Manley as vice-president in charge of sales.

The Hill Clutch Machine & Foundry Company, Cleveland, Ohio, has appointed C. R. McGahey to its sales engineering staff in the South.

The C. F. Pease Company has moved its New York sales headquarters to the Ashforth Building, 12 East 44th St.

The Consolidated Ashcroft Hancock Company has transferred its Chicago office to 605 W. Washington Boulevard, where the staff of the American Schaeffer & Budenberg division is also located.

MARKET CONDITIONS *and* PRICE TRENDS

Coal-Tar Dye Production Established Record in 1927

Domestic production was larger, on a quantitative basis, than total consuming requirements with exports far exceeding imports.

According to the eleventh annual Census of Dyes, which was issued by the U. S. Tariff Commission in the latter part of October, production of coal-tar dyes in that year established a record for the domestic industry. Total output was placed at 95,167,905 lb., which represents an increase of 8.2 per cent over production of 1926. Sales amounted to 98,339,204 lb. as compared with 86,255,836 lb. in the preceding year. The fact that sales outstripped production accounts for the reduction in stocks on hand from 30,233,079 lb. on Jan. 1, 1927, to 26,729,579 lb. on Dec. 31, 1927.

Among the changing aspects of the domestic industry as revealed by the census figures, attention is directed to the steadily diminishing number of producers. In 1927 the number of producers was given as fifty-two, exclusive of three makers of stains and indicators. This is a decrease of seventeen since 1925 and of thirty-eight since 1919. The reduction in the number of dye plants is referred to as a natural result of severe competition. It is also stated that the trend toward fewer manufacturers will probably continue until productive capacity more nearly conforms to the demands of the home and export markets. Elimination or amalgamation of plants is forced by the keenness of competition. Many firms produce relatively small quantities of low-priced dyes; others specialize in a few complex colors which are difficult to manufacture. Many of those in the latter group will probably continue operations; those producing low-cost colors on a small scale will hardly survive the competition offered by large-scale manufacturers.

Another feature of the dye industry, has been the declining trend of prices. The weighted average price of all domestic dyes sold in 1927 was 7 per cent less than the weighted average of those sold in 1926. Competition among domestic manufacturers has been severe, resulting in price concessions in both high- and low-priced dyes. Since 1917, prices have steadily declined. Had the average price received for dyes in 1921 prevailed in 1927, sales in the latter year would have totaled $81,621,539 instead of the actual figure—$38,532,795.

Breaking down the figures for domestic production it is found that the greatest expansion has taken place in the classification of vat dyes. The output of vat dyes other than indigo was 5,961,688 lb., an increase of 48 per cent over the 1926 production which in turn was 54 per cent larger than that for 1925. Production of sulphur dyes also showed large expansion in 1927. Domestic production of dyes according to the principal classifications will be found in the accompanying table.

Despite the keen competition which prevailed in foreign markets, exports of dyes in 1927 amounted to 26,770,560 lb. which represents an increase of more than 3.7 per cent. The principal markets in the export trade are found in China, Japan, Canada, and British India. Shipments to China, during the year, were 20 per cent larger than in 1926. The low-priced bulk dyes, such as indigo and sulphur black, are the principal selections figuring in the export trade. Exports of dyes in the last six years are given in the accompanying table.

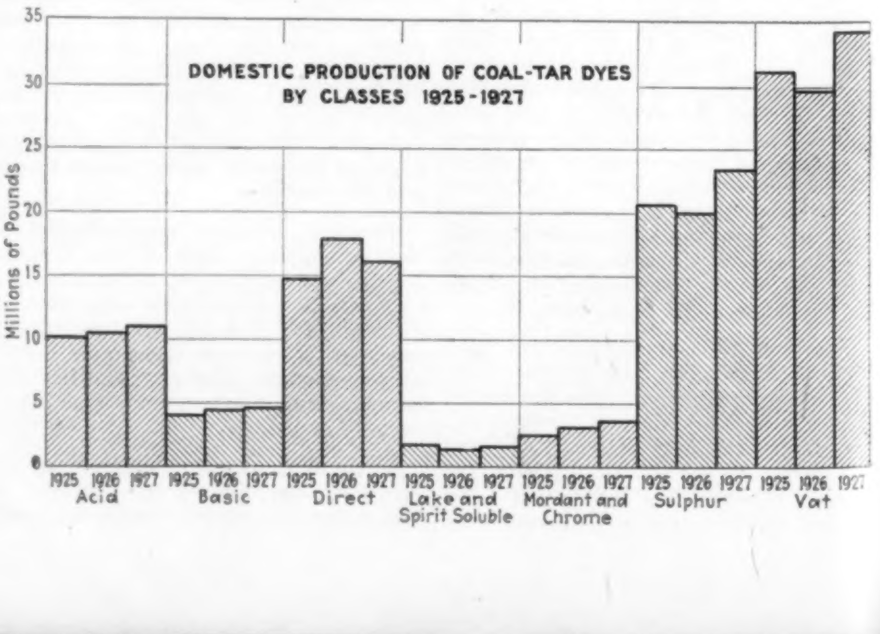
With the increase in domestic production and in the variety of selections, demand for dyes of foreign origin has declined. In 1927 importations of coal-tar dyes amounted to 4,233,046 lb., or a decline of 10 per cent as compared with the quantity imported in 1926. Germany and Switzerland supply the larger part of our dye imports. Classified by method of applications, 41 per cent of imports in 1927 was vat dyes, 17 per cent direct dyes, 15.5 per cent acid dyes, 11.5 per cent mordant and chrome dyes, and the remainder basic, sulphur, and spirit soluble dyes. Imports of dyes for 1925-1927, according to classification, are included in the accompanying table.

Exports of Coal-Tar Dyes

	Lb.	Value
1922	8,344,187	$3,996,443
1923	17,924,200	5,565,267
1924	15,713,428	5,636,244
1925	25,799,889	6,694,360
1926	25,811,941	5,950,159
1927	26,770,560	5,495,322

Domestic Production and Imports of Coal-Tar Dyes by Classes, 1925-1927

Classification	1925 Production, Lb.	1925 Imports, Lb.	1926 Production, Lb.	1926 Imports, Lb.	1927 Production, Lb.	1927 Imports, Lb.
Acid	10,214,024	589,959	10,441,443	793,855	11,104,533	654,729
Basic	4,121,735	607,637	4,406,073	406,732	4,548,515	334,526
Direct	14,787,840	759,024	18,039,705	805,848	16,265,497	721,342
Lake and spirit soluble	1,606,795	57,540	1,428,100	86,106	1,540,711	134,778
Mordant and chrome	2,543,292	642,098	3,134,934	500,004	3,604,095	488.605
Sulphur	20,760,512	122,230	20,023,242	149,723	23,404,273	137,864
Vat (including indigo)	31,730,178	2,418,842	29,731,951	1,848,014	34,399,854	1,730,967
Indigo	29,121,817	1,952	25,701,530	2,806	28,438,166	6,057
Other vat	2,608,361	2,416,890	4,030,421	1,845,208	5,961,688	1,724,910
Unclassified	581,162	12,271	773,176	82,914	300,427	30,235
Totals	86,345,438	5,209,601	87,978,624	4,673,196	95,167,905	4,233,046



MARKET APPRAISAL OF CHEMICAL INDUSTRY

Net earnings for the nine months ended September 30, of the Mathieson Alkali Works amounted to $1,797,293.46, as compared with $1,609,766.90 for the corresponding period of 1927. After deductions for federal taxes and preferred dividends, the common stock earned 9.72 per share. This is at the rate of $12.96 per share for the year as compared with earnings of $11.27 per share in 1927.

Stockholders of Libbey Owens Sheet Glass Co. approved increase in capitalization to $25,000,000, from $10,000,000. New stock will be offered to stockholders of record November 15 at $115 in ratio of one new share for every five shares held.

Special meeting of stockholders of Hercules Powder Co. has been called for November 27 to vote on recommendation to increase common stock to 1,600,000 no-par shares from 200,000 shares $100 par. It is also proposed to exchange four shares of the new common for each share of present common, increasing the outstanding stock to 588,000 new no-par shares from 147,000 present $100 par shares.

Meeting of stockholders of Monsanto Chemical Works has been called for December 31 to vote on proposed increase in stock to 160,000 shares from 110,000. A portion of the additional stock will be offered to stockholders on basis of one new share for each seven held, at $50 a share. Proceeds of sale will be used to acquire a complete interest in Gresser-Monsanto Chemical Works, Ltd.

Archer-Daniels-Midland Co. in the closing quarter of the fiscal year ended August 31, reported the highest net income for any quarter in the past four years, bringing the total for the year to $2,018,510, equal after preferred dividends to $8.03 a share on the 213,712 common shares. Net for the last quarter was $627,982, or $2.58 a common share.

U. S. Industrial Alcohol Company has notified stockholders that it will redeem its 7 per cent preferred stock on April 15, 1929, at $125 and accrued dividends upon surrender of stock certificates at the American Exchange Irving Trust Company.

The Sherwin-Williams Company reports for the year ended on Aug. 31, a net income of $4,901,840 after all charges, equivalent after preferred dividends to $7 a share on the common stock. This compares with $4,728,701, or $6 a share, in the previous year. Sales amounted to $62,416,758, against $60,766,155.

Price Range Since Jan. 1 High	Price Range Since Jan. 1 Low	Stock	Price Range in October Oct. 1	Price Range in October High	Price Range in October Low	Price Range in October Oct. 31
86⅞	59	Air Reduction	80¾	86⅞	77	79¾
14⅞	7⅛	Ajax Rubber Co.	10	10⅛	8⅛	8⅛
240¾	146	Allied Chemical	198	240¾	196¾	224¾
125¾	120⅛	Allied Chemical, pf.	121¾	123	122	122¾
23¾	15⅜	Am. Ag. Chemical	19⅞	20	17⅞	18⅞
76⅛	55⅞	Am. Ag. Chemical, pf.	67⅛	71⅞	63¾	65¾
53⅛	30¾	American Cyanamid, B	34⅛	39⅞	33¾	38
15⅞	8¾	Am. Hide & Leather	10	10	8¾	9
136⅛	56⅞	American Linseed	115¼	132	113	128
150	86⅛	American Linseed, pf.	....	150	128	....
53⅞	39	American Metals	52⅛	52⅛	48¼	50
24	13	Am. Rayon Products	19½	19¾	14⅛	17
28¾	11⅞	Am. Solvents & Chemical	21⅛	21⅛	17⅛	19⅞
54	26⅛	Anglo-Chile Nitrate	35⅞	39	27⅞	31⅞
106⅛	55½	Archer-Daniels-Midland	80	98⅛	79⅛	94
33¾	26⅛	Ass. Dyeing & Printing	29⅛	33⅞	28⅞	31⅞
101	63	Atlas Powder	82	90	80¼	80¼
23⅛	12¼	Beacon Oil	18⅞	23⅛	17⅞	20⅞
83⅛	70¾	Beechnut Packing	76	80¼	74¾	78
78¾	65½	Bon Ami, A.	72⅛	76	72⅛	73
86	65	Bristol-Myers	82⅞	86	81⅛	82
36	24	Calif. Petroleum	35	36	34⅛	....
103	53⅛	Celanese Corp.	61	67	54⅞	59⅛
112	98⅛	Celanese Corp., pf.	....	108	105⅞	....
63⅛	30¼	Certainteed	40¼	44	30½	31¾
56⅛	45½	Chickasha Cotton Oil	52¼	56⅛	49⅛	49⅛
225¾	137⅞	Commercial Solvents, B	214⅛	225¾	201	213
89¾	64⅞	Corn Products	86¼	87⅞	81⅛	83⅛
66¾	34⅞	Davison Chemical	63¾	66½	56¾	58⅞
61	40	Devoe & Raynolds	55	55	51	51⅞
120	108	Devoe & Raynolds, pf.	112	114¾	112	112⅛
442	310	Du Pont	400	442	390	425
121⅛	114	Du Pont 6 pc. db.	117	118⅛	117⅛	118
194½	163	Eastman Kodak	179	194	176½	180
238	165	Firestone Tire	172⅛	175	165	170⅛
17¾	8⅞	Fisk Rubber	11	12¼	10⅞	11⅛
89⅞	65	Fleischmann	86¼	89⅞	79⅛	80
109½	43	Freeport Texas	59⅞	60⅛	43	45⅞
30	20⅞	Glidden	29	29⅛	26½	27⅞
105	95	Glidden, pf.	104	104⅛	103	103¾
111½	71	Gold Dust	102⅞	109⅞	97⅛	102⅞
99⅞	68⅛	Goodrich Co.	85¼	89⅛	78¾	79
167	119	Houston Oil	138	144⅞	133	134⅛
146	132	Industrial Rayon	....	146	132	132
20⅞	13	Int. Ag. Chemical	15¾	15¾	13	14
83⅛	48⅞	Int. Ag. Chemical, pf.	77¾	79	75	78⅛
86⅞	50	International Paper	71¾	72	50	53
69	49⅛	International Salt	57⅛	58	54	55
25	19¾	Kelley-Springfield	26⅛	26⅛	21	....
....	....	Lee Rubber & Tire	21	26¼	20⅛	21
64⅞	38	Lehn & Fink	63	64⅞	57	57
....	....	Libby-Owens	157¾	180	141⅛	175
91	63⅛	Liquid Carbonic	79¾	82⅛	75⅛	79
167⅛	117¾	Mathieson Alkali	142¾	167⅛	139	156⅞
....	....	Monsanto Chemical	....	93	84	....
58⅛	29½	Nat'l. Dist. Products	42¾	43⅞	38	38
136	115	National Lead	124	124	117	117
260	180¾	New Jersey Zinc	225⅛	233¾	224¾	228
71⅞	58⅛	Ohio Oil	62⅛	65	60¾	63⅛
95⅞	74⅛	Owens Bottle	80¼	85⅛	78	82⅞
....	....	Palmolive Peet	....	....	....	....
47⅞	35½	Phillips Petroleum	43⅛	45¾	41	44½
300	210	Pittsburgh Plate Glass	....	289	279	280
....	....	Pratt & Lambert	61	64¾	60⅞	60⅞
300	217	Procter & Gamble	....	283	275⅛	....
28⅛	19	Pure Oil	24¾	28⅛	24	26½
....	....	Sherwin-Williams	....	92	88	91
29	17	Silica Gel	22¾	23⅛	20⅛	21⅛
44⅞	17⅞	Sinclair Oil	30⅞	39⅛	27⅞	37
41⅞	25	Skelly Oil	35¼	39	34	36⅛
66⅛	53	Standard Oil, Cal.	61⅞	63⅞	59¾	61⅛
52⅞	37⅞	Standard Oil, N. J.	46	47⅞	45⅞	47
41⅛	28¾	Standard Oil, N. Y.	35¾	36¾	34¾	35½
7⅞	2½	Standard Plate Glass	5	5⅞	4	4½
59⅞	31	Sun Oil	55⅛	65⅛	54	61⅞
....	....	Swan & Finch	....	....	....	....
17⅞	10⅛	Tenn. Copper & Chemical	16¼	17⅞	15⅛	16½
72¾	50	Texas Corp.	68	70⅛	66	67⅛
80⅞	62⅛	Texas Gulf Sulphur	71⅞	74⅞	68⅛	69⅞
25	14¾	Tidewater Oil Ass.	22	24	20⅞	21⅛
630	450	Tubize Silk	486	599	478	584
202	136⅛	Union Carbide	191⅛	202	178⅛	189
57	42¾	Union Oil, Cal.	51	56	49	52
95	52¼	United Piece Dye	86	89¾	85	....
138	102⅛	U. S. Ind. Alcohol	130	138	124⅛	130⅞
51	22	U. S. Leather	39¾	40¾	32⅛	34
63½	27	U. S. Rubber	39½	44¾	36½	37⅛
87⅞	72	Vacuum Oil	82⅛	85	79⅛	84
08	60	Vanadium Corp.	81	88⅛	76⅛	85
78⅞	58	Vick Chemical	73⅞	74½	72	72⅛
18⅞	12	Va. Ca. Chemical	14⅞	14⅞	13	13¾
57	44⅞	Va. Ca. Chemical, pf.	52	52⅛	48⅛	52
98⅞	67	Wesson Oil	81¾	96⅞	81½	91⅞
35	22	Wilson & Co.	12⅞	12¼	11	11

ECONOMIC INFLUENCES *on production and consumption of* CHEMICALS

Increase in Automobile Production Broadens Demand for Chemicals

Record Activities in Automotive Industry Reflected in Movement of Raw Materials

AUTOMOBILE and truck production in the first ten months of this year surpassed all previous marks for a corresponding period by reaching a total of 4,068,727 units, according to a report submitted to the directors of the National Automobile Chamber of Commerce.

The previous record for the first ten months of a year was established in 1926, when 4,062,110 cars and trucks were turned out. The output for October was estimated at 397,000 motor vehicles, against 434,915 in September and 227,510 in October last year.

This increase in automobile production has had a direct bearing on demand for chemicals and related products. Increased demand for solvents and other lacquer materials, for chemicals used in oil refining, and for chemicals used in the anti-freeze trade, may be mentioned as examples of the impetus given to the chemical industry by expansion in automobile production.

The rayon industry which also is passing through a record-producing year, has contributed materially toward widening the outlet for chemicals. Running through the list of industries which are consumers of chemicals, it is found that, with few exceptions, progress has been made and ample evidence is at hand to warrant the statement that production of chemicals in the first ten months of this year has exceeded that for the corresponding period of 1927.

INDUSTRIAL production during September, according to the weighted index of the Federal Reserve Board, after adjustments for seasonal variations, was higher than at any other time on record. The principal gains over a year ago occurred in the output of automobiles, rubber tires, iron and steel, and cement, brick and glass, while a decline from last year was registered in the output of textiles. Mineral production, after adjustment for seasonal conditions, showed gains over both the previous month and September of last year, the principal increase over last year occurring in copper.

Stocks of commodities held at the end of September were higher than at the end of the previous month, but showed a decline from a year ago, decreases from last year being registered both in raw materials and manufactured goods. Contrasted with the preceding month, stocks of manufactured goods were smaller, while raw materials were larger.

The general index of unfilled orders showed a gain over both the previous month and September of last year. Compared with August, unfilled orders for textiles were larger but forward business on the books of lumber mills and manufacturers of transportation equipment showed declines. As compared with a year ago, iron and steel and lumber showed larger unfilled orders, while textiles and transportation equipment showed declines.

EARLIER reports which estimated a very large cotton crop, combined with declining values for cotton, had the effect of slowing up activities in the fertilizer industry and created an uncertain position in the market for fertilizer chemicals. As the season advanced, however, estimates on the yield of cotton were revised downward and market values recovered accordingly. Fertilizer tag sales in the southern states in September were 36.6 per cent less than for September, 1927. In October fertilizer tag sales in the same section 17.9 per cent larger than for October, 1927. The outlook, therefore, for chemicals which enter into fertilizer manufacture has improved considerably during the past month.

Prospects for the tonnage movement of chemicals after the turn of the year may be measured with a certain degree of accuracy by the volume of business already placed for delivery in 1929. In many cases the contracting movement has run to larger totals than at the corresponding time last year and on that basis, chemical manufacturers will enter the new year in a very favorable position.

Practically every chemical manufacturing country is dependent upon foreign countries for some of its basic materials and imports are as much an indication of the status of the chemical industry as exports. The imports of these crude or semi-prepared materials which the United States must buy from foreign countries accounted for four-fifths of the total chemical imports or $135,000,000 in the first nine months of 1928, an increase of 11 per cent over the corresponding period of 1927.

The exports on the other hand of this type of goods accounted for less than two-fifths of the total chemical exports or $50,000,000, a decrease of 19 per cent from the corresponding period of 1927.

The increase in imports of these materials was largely confined to crude drugs and botanicals, essential oils, fertilizers, and pyrites. In the exports, naval stores were chiefly responsible for the decline, and drop in price had much to do with the marked falling off in total values.

In the manufactured and competitive chemical lines imports of $34,000,000 were about the same while exports of $90,000,000 were 8 per cent greater than last year. Some of the outstanding gains in foreign sales of processed chemicals were made in disinfectants and insecticides, in sodas, and in paints.

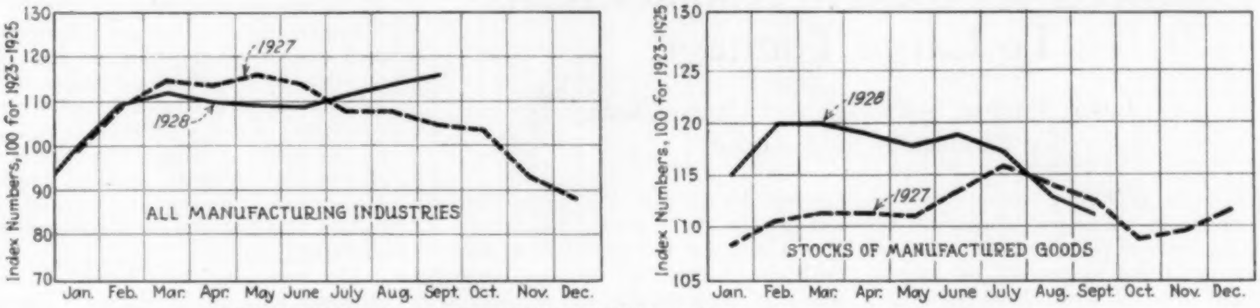
In the industrial chemical and chemical specialty lines, the figures of both exports and imports during the current nine months would indicate not alone the continued growth in foreign sales of the increasingly popular specialty lines in general, but also a recuperation of American business in those commodities which have been suffering from foreign competition especially the synthetic. Total industrial chemical exports, including chemical specialties attained the peak $30,800,000; were one-sixth greater than during the corresponding period of last year; and were 80 per cent greater than imports.

It will be recalled that American manufacturers have been concentrating on development of chemical specialties trade and have become, perhaps the world's leading source for these commodities. During the Jan.-Sept., 1928, period exports of industrial chemical specialties were nearly half as large again as during the corresponding period of 1927. Industrial chemicals, however, were only 3 per cent more and equalled $19,600,000.

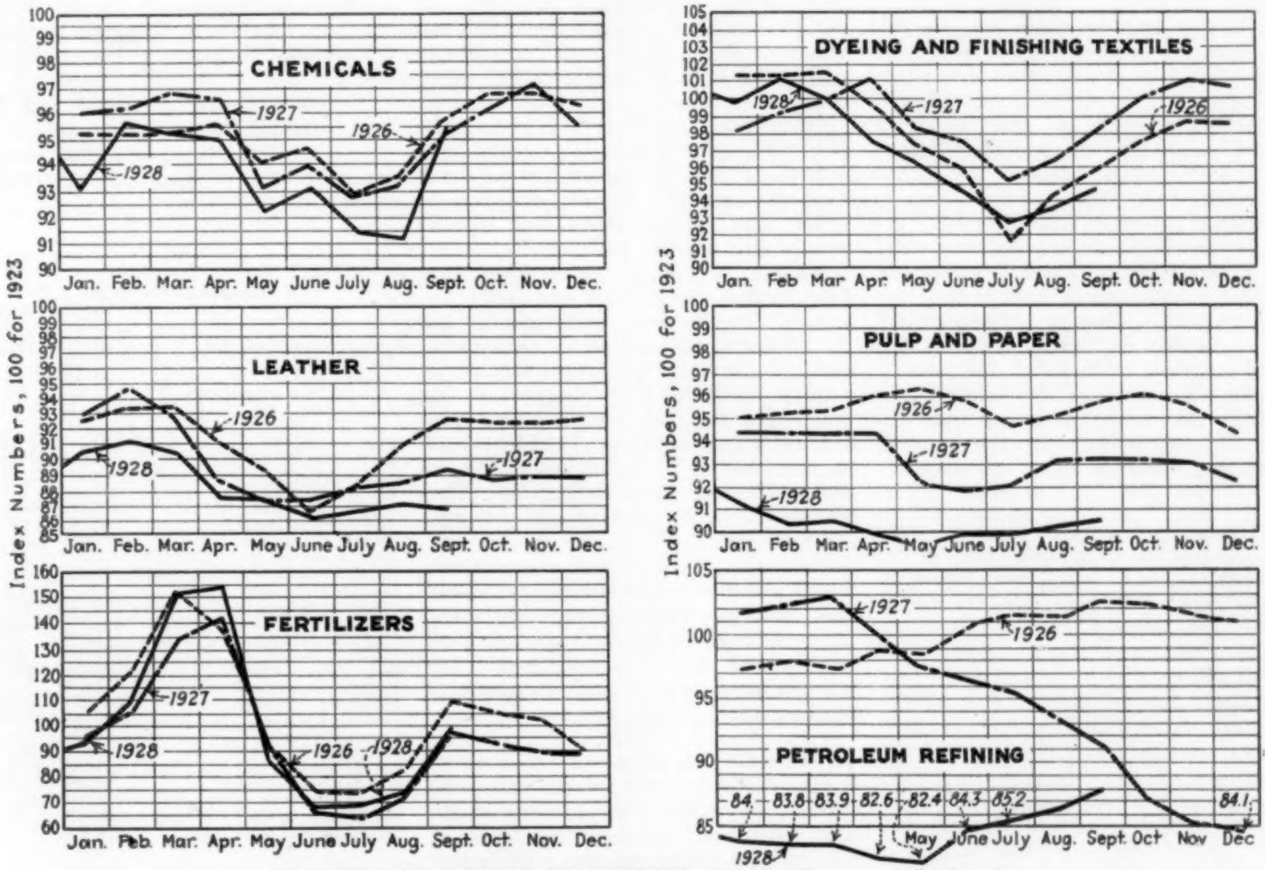
Of prominence in the specialty field are the disinfectants and insecticides which recorded an increase of 15 per cent in values to $4,500,000.

THE big decline in exports of crude coal tar products is the noteworthy incident of foreign trade in both directions. It is believed that there are three reasons for this enormous drop in exports of crude coal tar to $362,000 (94,000 bbl.) and of crude coal tar pitch and coal tar pitch coke to $548,000 (34,000 tons): (1) the higher cost of coal in the United States has caused more tar to be used as fuel; (2) the larger production in foreign consuming countries with lessened demand from their previous source of the supply; (3) a greater consumption for the distillation of creosote oil which has an exceptionally large domestic consumption with many millions of dollars worth imported annually.

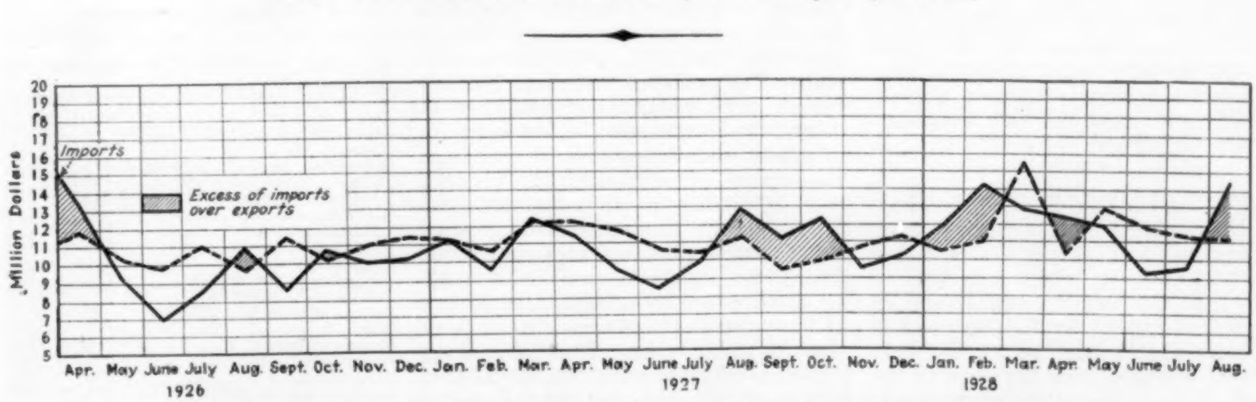
Indexes of Activity in Producing and Consuming Industries



VOLUME OF PRODUCTION *(U. S. Dept. of Commerce)*



FACTORY EMPLOYMENT *(U. S. Dept. of Labor)*



FOREIGN TRADE IN CHEMICALS AND ALLIED PRODUCTS

MARKET CONDITIONS *and* PRICE TRENDS

Contract Business in Alkalies Runs To Large Tonnage

Large Part of Soda Ash and Caustic Soda Production Sold Ahead

ONE OF THE outstanding features in recent trading in chemicals has been the active placement of contract orders involving deliveries of caustic soda and soda ash over all of next year. Some producers of these alkalies have arranged to increase their outputs in 1929 and confidence in such action has been strengthened by the fact that contract commitments to date are considerably larger than was the case at this time last year. From the present condition of the market it is expected that consumption in 1929 will exceed that of the present year and keep intact the steady annual growth which has characterized the alkali business in the last few years.

Contract prices for 1929 deliveries are on the same basis as for 1928 but there is a firmer tone to values as closer adherence to the quoted figures has distinguished the business so far placed. The reduction in contract prices for liquid chlorine, as reported last month, may be regarded as a stabilizing factor on prices for caustic soda and soda ash especially as far as makers employing the electrolytic method are concerned.

DENATURED alcohol has been passing freely against existing orders but production has been sped up to take care of the seasonal increase in demand occasioned by the requirements of the anti-freeze trade. Prices for alcohol are firm with the trend upward. Quotations for molasses for 1929 delivery are higher than the levels reached this year and evidently production costs for alcohol will be enhanced next year. The aggregate production of alcohol by members of the Industrial Alcohol Institute during September was 9,165,993 gal. Stocks held by all members on September 30 amounted to 16,587,548 gal. or an increase of 2,404,396 gal. from the total held on August 31. The stocks on hand included ethyl alcohol, 6,766,610 gal.; completely denatured alcohol, 8,555,011 gal.; and specially denatured alcohol, 965,927 gal.

DEVELOPMENTS in fertilizer chemicals and in the finished products are regarded as taking on deeper market significance which may lead to changes in the relative importance of different materials. In the first place is the evidence of a large future domestic supply of nitrogen from the air. In the second place is the growing tendency to produce mixed fertilizers which are cutting deeply into the fields formerly usurped by the ordinary mixtures. As a case in point the consul at Frankfort-on-Main, Germany recently reported that it is expected that the production of mixed fertilizers in the new factory of the Kali-Industrie A. G. of Cassel and the Klocknerwerke of Rauxel will soon start production. It is planned to produce a high percentage nitrogen and potash fertilizer from ammonia and crude potash, to replace to a considerable extent the sales of simple potash products and obviously to compete with the "Nitrophoska" of the I. G. Farbenindustrie. The Kali-Industrie's second new factory in Sondershausen for the same kind of fertilizer, the construction of which was started about nine months ago, is also nearing completion.

Export buying of borax which has been active throughout the year, increased in volume in recent months and in September, outward shipments reached the total of 12,884,466 lb. as against 5,410,060 lb. in September last year. For the nine months ended September, exports totaled 115,512,949 lb. as compared with 48,712,583 lb. for the corresponding period of 1927. This represents an increase of 137 per cent for the period.

Producers of oxalic acid are well sold ahead and there is a scarcity of stocks for prompt and nearby shipment. Imports so far this year have fallen off heavily and evidently home production has not been large enough to take care of consuming requirements.

INTEREST in chemicals produced by the distillation of wood has been increased by recent riser in sales prices. The price trend bears out the truth of reports that consumption has proceeded at a rate in excess of production. Production of methanol and acetate of lime for the year to date is considerably below the totals reported for the corresponding period of last year. Formaldehyde was marked one cent per lb. during the month with higher costs for methanol accounting for the change. Production of formaldehyde in 1927 was 29,920,072 lb., as compared with 31,953,204 lb. in the preceding year. Ethel acetate also sold at higher levels during the month because of the cumulative effect of advances in acetate of lime and their reflection in the position of acetic acid. That consuming call for ethyl acetate has broadened is attested by the fact that domestic production in 1927 amounted to 49,203,156 lb., compared with an output of 43,661,465 lb. in 1926.

Importations of barium chloride have been of limited volume for some months and the domestic output is well sold ahead. This has created a strong condition in the spot market not only in the way of advancing values but also in cutting down supplies available for prompt shipment. Barium carbonate also has shown a strengthening tendency.

The metal markets have had some influence as a market factor. Tin salts were sensitive to fluctuations in the metal and settled at fractionally higher levels. Copper, which led in the upward price movement in the metal market was responsible for an advance in copper sulphate although the latter is passing through a seasonal quiet period.

Yellow prussiate of potash has been in firm hands for some time and unsold stocks are reported to be light. Importers have been offering yellow prussiate of soda on contracts.

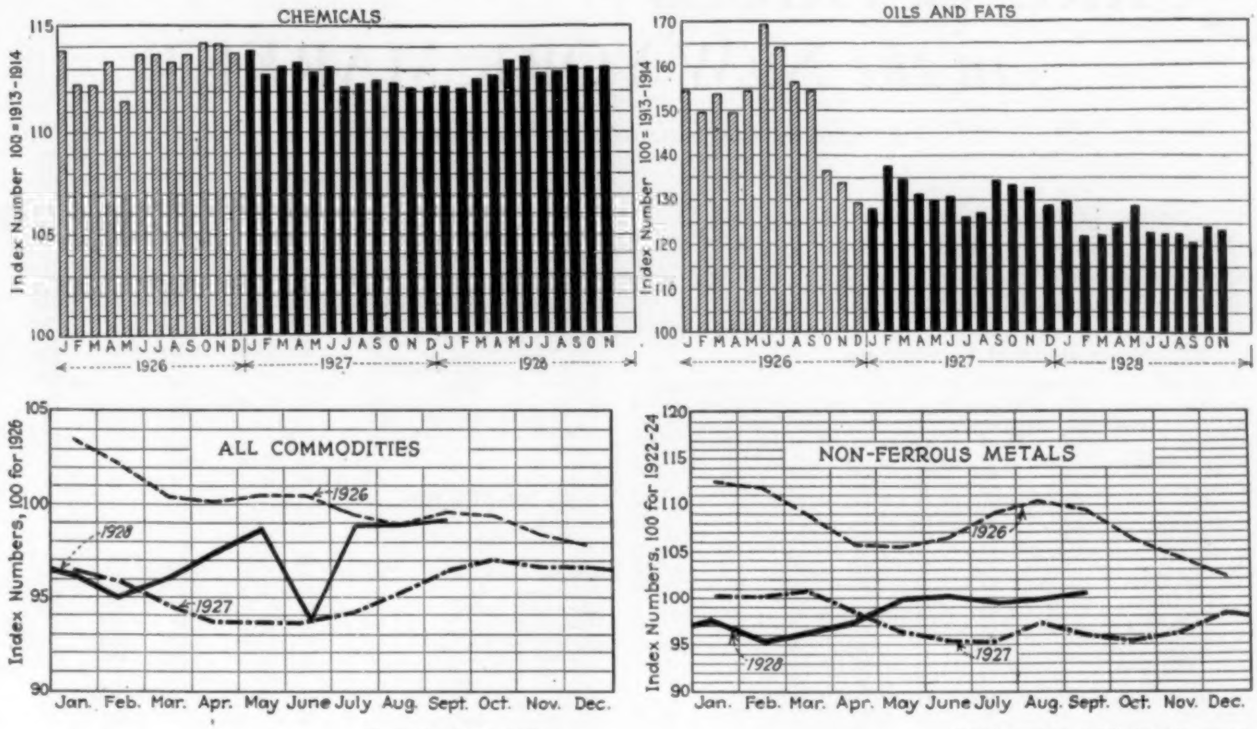
Imports of Chemicals

	September 1927	September 1928
Dead or creosote oil, gal.	6,989,937	4,063,074
Pyridine, lb.	9,328	....
Coal-tar acids, lb.	6,000	104,492
Coal-tar intermediates, lb.	35,016	146,387
Arsenic, white, lb.	2,807,740	1,569,391
Acid, citric, lb.	....	....
Acid, formic, lb.	232,254	62,842
Acid, oxalic, lb.	134,264	72,292
Acid, sulphuric, lb.	1,878,454	3,162,883
Acid, tartaric, lb.	273,952	244,256
Ammonium chloride, lb.	1,477,770	819,904
Ammonium nitrate, lb.	972,245	1,448,043
Barium compounds, lb.	907,608	1,096,434
Calcium carbide, lb.	112,002	375,500
Cobalt oxide, lb.	30,100	52,345
Copper sulphate, lb.	....	493,971
Bleaching powder, lb.	198,131	151,991
Glycerine, crude, lb.	1,661,937	359,069
Glycerine, ref., lb.	515,786	37,354
Iodine, crude, lb.	103,640	74,530
Magnesium compounds, lb.	1,729,056	1,099,925
Potassium cyanide, lb.	24,434	701
Potassium carbonate, lb.	504,053	1,187,738
Caustic potash, lb.	1,240,251	1,040,388
Cream of tartar, lb.	36,736	....
Potassium chlorate, lb.	918,563	994,386
Sodium cyanide, lb.	1,838,205	3,189,660
Sodium ferrocyanide, lb.	189,194	39,901
Sodium nitrate, lb.	2,369	....
Sodium nitrate, ton	64,753	36,644
Sulphate of ammonia, ton	4,408	2,505

Exports of Chemicals

	September 1927	September 1928
Benzol, gal.	997,336	3,011,489
Acid, acetic, lb.	....	15,157
Acid, sulphuric, lb.	454,326	581,760
Other acids, lb.	683,913	468,060
Methanol, gal.	20,526	32,540
Glycerine, lb.	33,265	41,001
Formaldehyde, lb.	101,928	193,565
Ammonium compounds, lb.	258,404	128,866
Aluminum sulphate, lb.	3,525,303	3,624,277
Acetate of lime, lb.	....	448,539
Calcium carbide, lb.	578,731	69,862
Bleaching powder, lb.	932,582	1,385,355
Copper sulphate, lb.	422,661	180,439
Potassium compounds, lb.	252,137	1,359,598
Sodium bichromate, lb.	711,048	435,912
Sodium cyanide, lb.	68,375	122,867
Borax, lb.	5,410,060	12,884,466
Sodium carbonate, lb.	5,962,454	5,569,120
Sodium silicate, lb.	4,840,038	5,406,672
Caustic soda, lb.	5,336,973	7,457,119
Sodium bicarbonate, lb.	1,214,596	852,247
Sulphate of ammonia, ton	9,907	6,597
Sulphur, ton	53,926	82,737

CHEM. & MET. *Weighted Indexes of* PRICES



U. S. Dep't of Labor — *Engineering & Mining Journal*

Wood Distillation Chemicals Continue Upward Price Tendency

CLOSE inter-relationship which exists in the manufacture of wood distillation chemicals in exemplified by the strong price tone which is found in the market for those products. Curtailed outputs have limited offerings of acetone, methanol, and acetate of lime. Higher prices for methanol have formed a basis for advancing production costs for formaldehyde. Upward revisions in price schedules for acetate of lime have been followed by advances in the asking prices for acetic acid. Present conditions are not expected to improve in the near future and strong markets may be expected for these chemicals until production has been speeded up in closer harmony with consuming requirements.

The announcement of contract prices on liquid chlorine for delivery over next year brought the reduction in quotations which had been anticipated. New contracts for caustic soda and soda ash are being written at the same level as prevailed for the current year. On contract business placed so far with consumers of alkali, it is stated that the quoted prices are being maintained whereas a year ago considerable tonnage was booked below the openly quoted figure. To a considerable extent the lowering in price on liquid chlorine is credited as being responsible for the steadiness in prices for alkalies.

DENATURED alcohol is another commodity which has borne out earlier predictions that the price trend would be upward. While consumption in the anti-freeze may show some fluctuation according to climatic conditions, there is little hope for an easing off in values because of an oversupply of stocks. On the other hand the course of the market for molasses foretells high production costs for alcohol and guarantees the maintenance of current quotations.

Reductions in the output of niter cake have increased demand for salt cake and while competition among sellers of the latter is still keen, there has been some recovery from the very low price levels that existed in recent months. It is predicted that the price trend will continue upwards if consumption holds up to expectations. Firmness in asking prices for niter cake also is reported with smaller supplies making any decline improbable.

Varying price changes have run through the market for vegetable oils and fats. The weighted index number for the month showed a decline with the greatest influence coming from the easier position of crude cottonseed oil and linseed oil.

Active crushing operations in cotton oil mills have increased offerings of oil and as the refined oil market has held above a hedging parity of crude the stability of the crude market is questioned. Refiners support has been a factor in steadying values but the probabilities favor recessions in value.

Linseed oil closed at a decline as compared with a month ago. Demand for oil has not been active and the easier price tone developed as a result of the slow trading movement and the lower position of flaxseed. Current price levels for oil are relatively low but a large crop of seed is in the making in the Argentine.

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	**113.08**
Last month	113.09
November, 1927	112.02
November, 1926	114.13

Higher prices have prevailed for acetate of lime, acetic acid, formaldehyde, and denatured alcohol but they have been counterbalanced by lower levels for chlorine and sulphate of ammonia and the weighted index number is slightly lower for the month.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This month	**123.60**
Last month	124.39
November, 1927	132.90
November, 1926	133.76

Tallow has held a very strong position but linseed, China wood, and cottonseed oils have shown an easier undertone. Production of crude cottonseed oil has gained in volume and larger offerings may bring about lower price levels temporarily. Menhaden oil has shown strength.

CURRENT PRICES *in the* NEW YORK MARKET

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to November 12.

Industrial Chemicals

		Current Price	Last Month	Last Year
Acetone, drums	lb.	\$0.14 -\$0.15	\$0.14 -\$0.15	\$0.12 -\$0.13
Acid, acetic, 28%, bbl.	cwt.	3.88 - 4.03	3.62½ - 3.87½	3.38 - 3.63
Boric, bbl.	lb.	.06½- .07	.06½- .07	.08½- .08½
Citric, kegs	lb.	.46 - .47	.46 - .47	.44½- .45
Formic, bbl.	lb.	.11 - .12	.11 - .12	.11 - .12
Gallic, tech., bbl.	lb.	.50 - .55	.50 - .55	.50 - .55
Hydrofluoric 30% carb.	lb.	.06 - .07	.06 - .07	.06 - .07
Lactic, 44%, tech., light, bbl.	lb.	.12 - .12½	.12 - .12½	.13½- .14
22%, tech., light, bbl.	lb.	.05½- .06	.05½- .06	.06½- .07
Muriatic, 18°, tanks	cwt.	.85 - .90	.85 - .90	.85 - .90
Nitric, 36°, carboys	lb.	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks.	ton	18.00 -20.00	18.00 -20.00	18.00- 20.00
Oxalic, crystals, bbl.	lb.	.11 - .11½	.11 - .11½	.11 - .11½
Phosphoric, tech., c'bys.	lb.	.08½- .09	.08½- .09	.08½- .09
Sulphuric, 60°, tanks	ton	11.00 -11.50	11.00 -11.50	10.50 -11.00
Tannic, tech., bbl.	lb.	.35 - .40	.35 - .40	.35 - .40
Tartaric, powd., bbl.	lb.	.37½- .38	.38 - .38½	.36 - .37
Tungstic, bbl.	lb.	1.00 - 1.20	1.00 - 1.20	1.00 - 1.20
Alcohol, ethyl, 190 p'f., bbl.	gal.	2.68½- 2.71	2.68½- 2.71	3.75 - 4.00
Alcohol, Butyl, dr.	lb.	.18½- .19	.18½- .19	.19 - .20
Denatured, 190 proof				
No. 1 special dr.	gal.	.48 -......	.47	.48 -......
No. 5, 188 proof, dr.	gal.	.48 -......	.47	.48 -......
Alum, ammonia, lump, bbl.	lb.	.03½- .04	.03½- .04	.03½- .04
Chrome, bbl.	lb.	.05½- .05¾	.05½- .05¾	.05½- .06
Potash, lump, bbl.	lb.	.02¾- .03½	.02¾- .03½	.02¾- .03½
Aluminum sulphate, com., bags	cwt.	1.40 - 1.45	1.40 - 1.45	1.40 - 1.45
Iron free, bg.	cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Aqua ammonia, 26°, drums	lb.	.03½- .04	.03½- .04	.02½- .03
Ammonia, anhydrous, cyl.	lb.	.13½-......	.13½-......	.11 - .13
Ammonium carbonate, powd. tech., casks	lb.	.12 - .13	.12 - .13	.10½- .14
Sulphate, wks.	cwt.	2.40 -......	2.40 -	2.40 -......
Amylacetate tech., drums	gal.	1.75 - 2.00	1.75 - 2.00	1.75 - 2.00
Antimony Oxide, bbl.	lb.	.10½- .10½	.12 - .12½	.15 - .16
Arsenic, white, powd., bbl.	lb.	.04 - .04½	.04 - .04½	.04 - .04½
Red, powd., kegs	lb.	.09 - .10	.09 - .10	.09½- .10
Barium carbonate, bbl.	ton	57.50 -60.00	57.50 -60.00	50.00 -52.00
Chloride, bbl.	ton	63.00 -70.00	63.00 -70.00	56.00 -58.00
Nitrate, cask	lb.	.07½- .08	.07½- .08	.08 - .08½
Blanc fixe, dry, bbl.	lb.	.03½- .04	.03½- .04	.04 - .04½
Bleaching powder, f.o.b., wks., drums	cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Borax, bbl.	lb.	.02½- .03	.02½- .03	.04 - .04½
Bromine, cs.	lb.	.45 - .47	.45 - .47	.45 - .47
Calcium acetate, bags	cwt.	4.50 -......	4.00 -......	3.50 -......
Arsenate, dr.	lb.	.06½- .07	.06½- .07	.07 - .08
Carbide drums	lb.	.05 - .06	.05 - .06	.05 - .06
Chloride, fused, dr., wks.	ton	20.00 -......	20.00 -......	21.00 -......
Phosphate, bbl.	lb.	.07 - .07½	.07 - .07½	.07 - .07½
Carbon bisulphide, drums	lb.	.05 - .06	.05 - .06	.05½- .06
Tetrachloride drums	lb.	.06½- .07	.06½- .07	.06½- .07
Chlorine, liquid, tanks, wks.	lb.	.03 - .03½	.03½- .04½	.03½- .04½
Cylinders	lb.	.05 - .08	.05½- .08	.05½- .08
Cobalt oxide, cans	lb.	2.10 - 2.20	2.10 - 2.20	2.10 - 2.25
Copperas, bgs., f.o.b. wks.	ton	16.00 -17.00	16.00- 17.00	14.00 -17.00
Copper carbonate, bbl.	lb.	.17 - .17½	.17 - .17½	.17 - .17½
Cyanide, tech., bbl.	lb.	.49 - .50	.49 - .50	.49 - .50
Sulphate, bbl.	cwt.	5.50 - 5.60	5.30 - 5.50	5.00 - 5.10
Cream of tartar, bbl.	lb.	.27½- .28	.27½- .28	.27 - .28
Diethylene glycol, dr.	lb.	.10 - .15	.10 - .15	.15 - .20
Epsom salt, dom., tech., bbl.	cwt.	1.75 - 2.15	1.75 - 2.00	1.75 - 2.00
Imp., tech., bags	cwt.	1.15 - 1.25	1.15 - 1.25	1.35 - 1.40
Ethyl acetate, drums	gal.	.82 - .84	.82 - .84	.74 - .76
Formaldehyde, 40%, bbl.	lb.	.09½- .10	.08½- .09	.08½- .09
Furfural, dr.	lb.	.15 - .17½	.15 - .17½	.15 - .17
Fusel oil, crude, drums	gal.	1.30 - 1.40	1.30 - 1.40	1.40 - 1.50
Refined, dr.	gal.	2.50 - 3.00	2.50 - 3.00	2.50 - 3.00
Glaubers salt, bags	cwt.	1.10 - 1.20	1.10 - 1.20	1.00 - 1.10
Glycerine, c.p., drums, extra	lb.	.14 - .15	.14 - .15	.22½- .23
Lead:				
White, basic carbonate, dry, casks	lb.	.08½-......	.08½-......	.09 -......
White, basic sulphate, sck.	lb.	.07¾-......	.07¾-......	.08¾-......
Red, dry, sck.	lb.	.09¾-......	.09¾-......	.09¾-......
Lead acetate, white crys., bbl.	lb.	.13 - .13½	.13 - .13½	.13 - .13½
Lead arsenate, powd., bbl.	lb.	.13 - .14	.13 - .14	.12 - .13
Lime, chem., bulk	ton	8.50 -......	8.50 -......	8.50 -......
Litharge, pwd., csk.	lb.	.08¾-......	.08½-......	.08¾-......
Lithopone, bags	lb.	.05½- .06	.05½- .06	.05½- .06½
Magnesium carb., tech., bags	lb.	.06½- .07	.06½- .07	.07½- .08
Methanol, 95%, dr.	gal.	.55 -......	.55 -......	.53 -......
97%, dr.	gal.	.55 -......	.55 -......	.55 -......
Nickel salt, double, bbl.	lb.	.10 - .10½	.10 - .10½	.10 - .10
Single, bbl.	lb.	.10½- .11	.10½- .11	.10½- .11½

		Current Price	Last Month	Last Year
Orange mineral, csk.	lb.	\$0.11½-......	\$0.11½-......	\$0.11½-......
Phosphorus, red, cases	lb.	.62 - .65	.62 - .65	.62 - .65
Yellow, cases	lb.	.32 - .33	.32 - .34	.32 - .33
Potassium bichromate, casks	lb.	.08½- .08½	.08½- .08¾	.08½- .08½
Carbonate, 80-85%, calc., csk.	lb	.05½- .06	.05½- .06	.05½- .06
Chlorate, powd.	lb.	.06½- .07	.06½- .07	.08½- .09
Cyanide, cs.	lb.	.52 - .55	.51 - .53	.55 - .57
First sorts, csk.	lb.	.08½- .09	.08½- .09	.08½- .09
Hydroxide (c'stic potash) dr.	lb.	.07½- .07¾	.07½- .07¾	.07½- .07½
Muriate, 80% bgs.	ton	36.40 -......	36.40 -......	36.40 -......
Nitrate, bbl.	lb.	.06 - .06½	.06 - .06½	.06 - .07½
Permanganate, drums	lb.	.15 - .16	.15 - .16	.14 - .16
Prussiate, yellow, casks	lb.	.19½- .20	.18 - .19	.18 - .19
Sal ammoniac, white, casks	lb.	.047- .05	.047- .05	.05 - .05½
Salsoda, bbl.	cwt.	.90 - .95	.90 - .95	.90 - .95
Salt cake, bulk	ton	14.00 -17.00	14.00 -17.00	17.00 -19.00
Soda ash, light, 58%, bags, contract	cwt.	1.32 -......	1.32 -......	1.32 -......
Dense, bags	cwt.	1.35 -......	1.35 -......	1.35 -......
Soda, caustic, 76%, solid, drums, contract	cwt.	2.80 - 3.00	2.80 - 3.00	3.00 - 3.10
Acetate, works, bbl.	lb.	.05½- .06	.05½- .06½	.04½- .05
Bicarbonate, bbl.	cwt.	2.00 - 2.25	2.00 - 2.25	2.00 - 2.25
Bichromate, casks	lb.	.07 - .07½	.07 - .07½	.06½- .06½
Bisulphate, bulk	ton	3.00 - 3.50	3.00 - 3.50	3.00 - 3.50
Bisulphite, bbl.	lb.	.03½- .03¾	.03½- .03¾	.03½- .04
Chlorate, kegs	lb.	.05½- .06	.05½- .06	.06½- .06½
Chloride, tech.	ton	12.00 -14.75	12.00- 14.75	12.00 -14.00
Cyanide, cases, dom.	lb.	.18 - .22	.18 - .22	.18 - .22
Fluoride, bbl.	lb.	.08½- .09½	.08½- .09½	.08½- .09
Hyposulphite, bbl.	lb.	2.50 - 3.00	2.50 - 3.00	2.50 - 3.00
Nitrate, bags	cwt	2.15 -......	2.15 -......	2.40 -......
Nitrite, casks	lb.	.07½- .08	.07½- .08	.08 - .08½
Phosphate, dibasic, bbl.	lb.	.03 - .03½	.03 - .03½	.03½- .03¾
Prussiate, yel. drums	lb.	.11½- .12	.11½- .12	.12 - .12½
Silicate (30°, drums)	cwt.	.75 - 1.15	.75 - 1.15	.75 - 1.15
Sulphide, fused, 60-62%, dr.	lb.	.02¾- .03½	.02¾- .03	.03½- .04
Sulphite, crys., bbl.	lb.	.02½- .03	.02½- .03	.02½- .03
Strontium nitrate, bbl.	lb.	.09 - .09½	.09 - .09½	.09 - .09½
Sulphur, crude at mine, bulk	ton	18.00 -......	18.00 -......	18.00 -......
Chloride, dr.	lb.	.04 - .05	.04 - .05	.05 - .05½
Dioxide, cyl.	lb.	.09 - .10	.09 - .10	.09 - .10
Flour, bag	cwt.	2.70 - 3.00	2.70 - 3.00	2.70 - 3.00
Tin bichloride, bbl.	lb.	.15½-......	.15½-......	.17½-......
Oxide, bbl.	lb.	.54 -......	.54 -......	.64 -......
Crystals, bbl.	lb.	.37½-......	.37½-......	.41½-......
Zinc chloride, gran., bbl.	lb.	.06½- .06¾	.06½- .06¾	.06½- .06¾
Carbonate, bbl.	lb.	.10 - .11	.10 - .10½	.10 - .11
Cyanide, dr.	lb.	.40 - .41	.40 - .41	.40 - .41
Dust, bbl.	lb.	.08¾- .09	.08¾- .09	.09 - .10
Zinc oxide, lead free, bag	lb.	.06½-......	.06½-......	.06½-......
5% lead sulphate, bags	lb.	.06½-......	.06½-......	.06½-......
Sulphate, bbl.	cwt.	2.75 - 3.00	2.75 - 3.00	2.75 - 3.00

Oils and Fats

		Current Price	Last Month	Last Year
Castor oil, No. 3, bbl.	lb.	\$0.12¾-\$0.13	\$0.12¾-\$0.13	\$0.13 -\$0.13½
Chinawood oil, bbl.	lb.	.15¾-......	.15¾-......	.15½-......
Coconut oil, Ceylon, tanks, N. Y.	lb.	.08½-......	.08½-......	.08¾-......
Corn oil crude, tanks, (f.o.b. mill)	lb.	.08¾-......	.08½	.09½-......
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.07⅞-......	.09½-......	.09½-......
Linseed oil, raw, car lots, bbl.	lb.	.10 -......	.102-......	.096-......
Palm, Lagos, casks	lb.	.09 -......	.09 -......	.08 -......
Niger, casks	lb.	.08½-......	.07½-......	.09 -......
Palm Kernel, bbl.	lb.	.09½-......	.09½-......	.09 -......
Peanut oil, crude, tanks (mill)	lb.	.10 -......	.10 -......	.09½-......
Rapeseed oil, refined, bbl.	gal	.88 - .90	.88 - .90	.85 - .86
Soya bean tank (f.o.b. Coast)	lb	.09¾-......	.09¾-......	.09½-......
Sulphur (olive foots), bbl.	lb.	.10¼-......	.10¼-......	.10 -......
Cod, Newfoundland, bbl.	gal.	.65 - .67	.65 - .67	.63 - .65
Menhaden, light pressed, bbl.	gal.	.60 - .61	.60 - .61	.60 - .62
Crude, tanks (f.o.b. factory)	gal	.42½-......	.42½-......	.44 -......
Whale, crude, tanks	gal.	.73 -......	.73 -......	......
Grease, yellow, loose	lb.	.07¼-......	.07½-......	.06½-......
Oleo stearine	lb.	.10¾-......	.10¾-......	.12½-......
Red oil, distilled, d.p. bbl.	lb.	.09¾- .09½	.09¾- .09½	.09¾- .09½
Tallow, extra, loose	lb.	.08¾-......	.08¾-......	.08¾-......

Coal-Tar Products

		Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl.	lb.	\$0.60 -\$0.65	\$0.60 -\$0.65	\$0.60 -\$0.62
Refined, bbl.	lb.	.80 - .85	.85 - .90	.85 - .90
Alpha-naphthylamine, bbl.	lb.	.32 - .34	.35 - .36	.35 - .36
Aniline oil, drums, extra	lb.	.14½- .15	.15 - .16	.15 - .16
Aniline salts, bbl.	lb.	.24 - .25	.24 - .25	.24 - .25
Anthracene, 80%, drums	lb.	.60 - .65	.60 - .65	.60 - .65

Coal Tar Products (Continued)

		Current Price	Last Month	Last Year
Benzaldehyde, U.S.P., dr.	lb.	1.15 - 1.25	1.15 - 1.35	1.15 - 1.25
Benzidine base, bbl.	lb.	.65 - .70	.70 - .75	.70 - .72
Benzoic acid, U.S.P., kgs.	lb.	.57 - .60	.58 - .60	.58 - .60
Benzyl chloride, tech, dr.	lb.	.25 - .26	.25 - .26	.25 - .26
Benzol, 90%, tanks, works	gal.	.23 - .25	.22 - .23	.24 - .25
Beta-naphthol, tech., drums	lb.	.22 - .24	.22 - .24	.22 - .24
Cresol, U.S.P., dr.	lb.	.14 - .17	.14 - .17	.18 - .20
Cresylic acid, 97%, dr., wks.	gal.	.73 - .75	.73 - .75	.61 - .62
Diethylaniline, dr.	lb.	.55 - .58	.58 - .60	.58 - .60
Dinitrophenol, bbl.	lb.	.30 - .32	.31 - .33	.31 - .35
Dinitrotoluen, bbl.	lb.	.17 - .18	.17 - .18	.17 - .18
Dip oil, 25% dr.	gal.	.28 - .30	.28 - .30	.28 - .30
Diphenylamine, bbl.	lb.	.43 - .45	45 - .47	.45 - .47
H-acid, bbl.	lb.	.60 - .63	.63 - .65	63 - .65
Naphthalene, flake, bbl.	lb.	.05 - .06	.05 - .06	.04½ - .05
Nitrobenzene, dr.	lb.	.09 - .10	.08½ - .10	.09 - .10
Para-nitraniline, bbl.	lb.	.55 - .56	.52 - .53	.52 - .53
Para-nitrotoluine, bbl.	lb.	.28 - .32	.28 - .32	.28 - .32
Phenol, U.S.P., drums	lb.	13 - .14	13½ - 14	.18 - .19
Picric acid, bbl.	lb.	.30 - 40	30 - 40	30 - .40
Pyridine, dr.	lb.	1.35 - 1.50	1.35 - 1.50	3.00 - ......
R-salt, bbl.	lb.	.44 - .45	.47 - .50	.47 - .50
Resorcinal, tech, kegs	lb.	1.30 - 1.35	1.30 - 1.35	1.30 - 1.40
Salicylic acid, tech., bbl.	lb.	.30 - .32	.30 - .32	.30 - .32
Solvent naphtha, w.w., tanks	gal.	.30 - .35	.35 -	.35 - ......
Tolidine, bbl.	lb.	86 - .90	.95 - .96	.95 - .96
Toluene, tanks, works	gal.	40 -	.35 -	.35 - ....
Xylene, com., tanks	gal.	.30 35	36 - .41	.36 - .40

Miscellaneous

		Current Price	Last Month	Last Year
Barytes, grd., white, bbl.	ton	$23.00-$25.00	$23.00-$25.00	$23.00-$25.00
Casein, tech., bbl.	lb.	.16½ .17	.16½ - .17	.17½ - .18
China clay, dom., f.o.b. mine	ton	10.00 -20.00	10.00 -20.00	10.00 -20.00
Dry colors:				
Carbon gas, black (wks.)	lb.	.07½ - .08	.07½ - .08	.06½ - .07
Prussian blue, bbl.	lb.	.31 - .33	.31 - .33	.33 - .34
Ultramine blue, bbl.	lb.	.08 - .35	.08 - .35	.08 - .35
Chrome green, bbl.	lb.	.27 - .31	.27 - .30	.27 - .30
Carmine red, tins	lb.	5.25 - 5.50	5.25 - 5.50	5.50 - 5.75
Para toner	lb.	.60 - .70	.60 - .70	.80 - .90
Vermilion, English bbl.	lb.	1.80 - 1.85	1.80 - 1.85	1.80 - 1.85
Chrome yellow, C. P., bbl.	lb.	15½ - .16	15½ - .16	17 - .18
Feldspar, No. 1 (f.o.b. N. C.)	ton	5.75 - 7.00	5.75 - 7.00	5.75 - 7.00
Graphite, Ceylon, lump, bbl.	lb.	.08 - .08½	.08 - .08½	.08 - .09
Gum copal, Congo, bags	lb.	.07½ - .08	.07½ - .08	.09½ - .10
Manila, bags	lb.	.15 - .18	.15 - .16	.15 - .18
Damar, Batavia, cases	lb.	.22 - .23	.22 - .23	.25 - .25
Kauri, No. 1 cases	lb.	.48 - .53	.48 - .53	.55 - .57
Kieselguhr (f.o.b. N. Y.)	ton	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc.	ton	40.00 -	40.00 -	44.00 - ......
Pumice stone, lump, bbl.	lb.	.05 - .07	.05 - .08	.05 - .07
Imported, casks	lb.	.03 - .40	.03 - .40	.03 - .35
Rosin, H.	bbl.	9.60 -	9.55 -	8.35 - ......
Turpentine	gal.	.55½ -	.53½ -	.49½ - ......
Shellac, orange, fine, bags	lb.	.61 -	.61 -	.52 - .53
Bleached, bonedry, bags	lb.	.60 - .66	.60 - .66	.55 - .58
T. N. bags	lb.	.47 - .48	.47 - .48	.48 - .49
Soapstone (f.o.b. Vt.), bags	ton	10.00 -12.00	10.00 -12.00	10.00 -12.00
Talc, 200 mesh (f.o.b. Vt.)	ton	9.50 -	9.50 -	10.50 - ......
300 mesh (f.o.b. Ga.)	ton	7.50 -10.00	7.50 -10.00	7.50 -11.00
225 mesh (f.o.b. N. Y.)	ton	13.75 -	13.75 -	13.75 - ......

		Current Price	Last Month	Last Year
Wax, Bayberry, bbl.	lb.	$0.31 -$0.32	$0.31 -$0.32	$0.22 -$0.26
Beeswax, ref., light	lb.	.41 - .42	.41 - .42	.43 - .45
Candelilla, bags	lb.	.23 - .24	.23 - .24	.27 - .28
Carnauba, No. 1, bags	lb.	.46 - .48	.46 - .48	.62 - .63
Paraffine, crude 105-110 m.p.	lb.	.04½ - .05	.04½ - .05	.05½ - .06

Ferro-Alloys

		Current Price	Last Month	Last Year
Ferrotitanium, 15-18%	ton	$200.00-	$200.00-	$200.00- ....
Ferromanganese, 78-82%	ton	105.00-	105.00-	90.00- ....
Spiegeleisen, 19-21%	ton	33.00-	32.00-	33.00-35.00
Ferrosilicon, 14-17%	ton	45.00-	45.00-	....
Ferrotungsten, 70-80%	lb.	.95- .98	.95- .98	.95- .98
Ferro-uranium, 35-50%	lb.	4.50-	4.50-	4.50- ....
Ferrovanadium, 30-40%	lb.	3.15- 3.75	3.15- 3.75	3.15- 3.75

Non-Ferrous Metals

		Current Price	Last Month	Last Year
Copper, electrolytic	lb.	$0.15½-	$0.15½ -	$0.13½- ......
Aluminum, 96-99%	lb.	.24 - .26	.24 - .26	.25 - .26
Antimony, Chin. and Jap.	lb.	.11½-	.11½-	.11 - ......
Nickel, 99%	lb.	.35 -	.35 -	.35 - ......
Monel metal, blocks	lb.	.28 -	.28 - .28	.32 - .33
Tin, 5-ton lots, Straits	lb.	.49 -	.49 -	.56½- ......
Lead, New York, spot	lb.	6.50 -	6.50 -	6.25 - ......
Zinc, New York, spot	lb.	6.60 -	6.60 -	5.95 - ......
Silver, commercial	oz.	.58½-	.58½-	.57½- ......
Cadmium	lb.	.70 - .80	.70 - .80	.60 -
Bismuth, ton lots	lb.	1.70 -	1.70 -	1.85 - 2.10
Cobalt	lb.	2.50 -	2.50 -	2.50 - ......
Magnesium, ingots, 99%	lb.	.85 - 1.10	.85 - 1.10	.75 - .80
Platinum, ref.	oz.	76.00- 76.50	76.00- 76.50	66.00-
Palladium, ref.	oz.	42.00- 46.00	42.00- 46.00	52.00-53.00
Mercury, flask 75	lb.	123.00-	128.00-	128.00- ......
Tungsten powder	lb.	1.10- 1.15	1.10- 1.15	1.05- ....

Ores and Semi-finished Products

		Current Price	Last Month	Last Year
Bauxite, crushed, wks.	ton	$7.50- $8.00	$7.50- $8.50	$5.50- $8.75
Chrome ore, c.f. post	ton	21.00- 23.00	22.00- 24.00	22.00- 23.00
Coke, fdry., f.o.b. ovens	ton	2.85- 3.00	2.85- 3.00	3.25- 3.75
Fluorspar, gravel, f.o.b. Ill.	ton	17.00- 18.00	16.00-	17.00- ......
Ilmenite, 52% TiO_2, Va.	lb.	.00¾ .00¾	.00¾- .00¾	.00¾- ....
Manganese ore, 50% Mn., c.i.f. Atlantic Ports	unit	.36 - .38	.36 - .38	.36 - .38
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y.	lb.	.48 - .50	.48 - .50	.48- .50
Monazite, 6% of ThO_2	ton	130.00-	130.00-	120.00- ....
Pyrites, Span. fines, c.i.f.	unit	.13 -	.13 -	.13½- ......
Rutile, 94-96% TiO_2	lb.	.11 - .13	.11 - .13	.11 - .13
Tungsten, scheelite, 60% WO_3 and over	unit	11.25 -11.50	10.50 -10.75	11.25 -11.50
Vanadium ore, per lb. V_2O_5	lb.	nom.	nom.	.25 - .28
Zircon, 99%	lb.	.03 -	.03 - ..	.03 - ......

CURRENT INDUSTRIAL DEVELOPMENTS

New Construction and Machinery Requirements

Automobile Polish Plant—C. H. McAleer Mfg. Co., 4718 Burlingame Ave., Detroit, Mich., awarded contract for a 1 and 2 story, 105 x 200 ft. automobile polish plant on Lyndon Ave., to Max Bartholomaei Son & Co., 1574 East Warren Ave., Detroit, Mich. Estimated cost $60,000.

Battery Plant—American Battery Products Corp., c/o C. V. Chermendy, Wichita Falls, Tex., plans the construction of a battery plant. Estimated cost $60,000.

Brass and Copper Factory—Chase Brass & Copper Co., R. L. Coe, Pres., Waterbury, Conn., plans the construction of a 1 story factory at Cleveland, O. Estimated cost $250,000.

Briquetting Plant — Wyoming Carbonizing & Briquetting Co., Conroy, Ia., plans the construction of a plant to treat 4,000 ton of coal daily for making briquetts at Kemmerer, Wyo. Lugi process, controlled by German Lugi Corp., will be used.

Candy Factory—Loft Inc., Vernon Ave., Long Island City, N. Y., plans the construction of a 3 story, 50 x 95 ft. candy factory at Hamilton St. and Freeman Ave. Estimated cost $75,000. W. Higginson, 101 Park Ave., New York, N. Y., is architect.

Candy Factory—Sperry Candy Co., 140 Reed St., Milwaukee, Wis., will soon award contract for the construction of a 5 story, 50 x 140 ft. candy factory on Pittsburg St. C. H. Thoringer & J. Bruecker, 774 3rd St., Milwaukee, Wis., are architects.

Carbonic Acid Gas Plant—Canadian Carbonate Ltd., R. C. Holbrook, Mgr., 1 Hadley St., Montreal, Que., plans the construction of a plant for the manufacture of carbonic acid gas on Colbourne St. Estimated cost $150,000.

Chlorine—Central Bd. of Purchases, J. W. Nicholson, Purch. Agt., Milwaukee, Wis., will receive bids until Nov. 20 for 60,000 lbs. liquid chlorine.

Cement Plant—Kentucky Cement Corp., Frankfort, Ky., is having plans prepared for the construction of a cement plant. Estimated cost $2,500,000. Hunt Engineering Co., 701 New York Life Bldg., Kansas City, Mo., is engineer.

Chemical Plant — Salem Chemical Co., Osborn St., Salem, Mass., awarded contract for the construction of a 1 story addition to chemical plant, to Pitman & Brown, 11 Washington St., Salem, Mass.

Chemical Manufacturing Plant—McKesson & Robbins Co., Gresmere St., Fairfield, Conn., awarded contract for a 5 story, 100 x 200 ft. chemical manufacturing plant, to E. & F. Construction Co., 94 Wells St., Bridgeport, Conn. Estimated cost $155,000.

Chemical and Pigment Plant Addition—Chemical & Pigments Co., St. Helena, Md., awarded contract for the construction of a 2 story, 70 x 100 ft. addition to plant, to Price Construction Co., Maryland Trust Bldg., Baltimore, Md.

Chocolate Factory—Walter Baker & Co., Inc., Adams St., Milton, Mass., will build a 3 story addition to chocolate factory. Estimated cost $40,000. Private plans.

Coke Plant—Dominion Gas Co., S. B. Severson, Mgr., St. Thomas, Ont., is having plans prepared for the construction of a coke plant. Estimated cost $2,000,000.

Coke and Gas Plant—National Utilities Corp., Winnipeg, Man., plans an election to vote $500,000 bonds to equip coke and gas plant.

Coke Plant—Koppers Co., Waterfront St., New Haven, Conn., awarded contract for the construction of a 2 story 42 x 85 ft. coke screening plant and 4 story 37 x 44 ft. brick oven bin, also two chimneys 250 ft. high, 20 ft. in diameter, to Koppers Construction Co., Alabama Ave., New Haven, Conn. Estimated cost $155,000.

Copper Manufacturing Plant — Nichols Copper Co., Laurel Hills, L. I., N. Y., plans the construction of a 58 x 278 ft. copper manufacturing plant at Hobson and Halle Aves. Estimated cost $150,000. Private plans.

Copper Refining and Rolling Mill — Phelps-Dodge Corp., c/o Chamber of Commerce, El Paso, Tex., plans the construction of a copper refining and rolling mill near El Paso, Tex. Estimated cost $5,000,000. Private plans. Owner taking bids on complete equipment.

Corp and Insulation Plant—Mundet Cork & Insulation Ltd., 51 St. Lawrence St., Toronto, Ont., awarded contract for a 1 and 2 story, 100 x 150 ft. cork and insulation plant at Booth Ave. to H. A. Wickett Co., Ltd., 156 Front St. E., Toronto, Ont. Estimated cost $100,000.

Creamery and Milk Pasteurizing Plant—Quality Milk Co., c/o C. Ward, 201 North 10th St., Ft. Smith, Ark., is having preliminary plans prepared for the construc-

tion of a 2 story, 140 x 150 ft. creamery and milk pasteurizing plant to cost $60,000. Cable Engineering Co., Dallas, Tex., is engineer.

Enameling Plant — Landers, Frary & Clark, New Britain, Conn., awarded contract for the construction of a 123 x 200 ft. enameling building and 30 x 123 ft. storage building to Morton C. Tuttle Co., 862 Park Sq. Bldg., Boston, Mass. Estimated cost $110,000.

Extract Manufacturing Plant — V. V. Campbell & Co., Reno St., Oklahoma City, Okla., is having plans prepared for the construction of an extract manufacturing plant at 27th and Santa Fe Sts. Estimated cost $65,000. Private plans.

Gas Plant—Chase & Waring, 420 Lexington Ave., New York, N. Y., have acquired a site at Falls Rd. and Lake Ave., Baltimore, Md., and plans the construction of a glass plant.

Gas Plant—Drake-Jones Co., 210 First National Soo Line Bldg., Minneapolis, Minn., has made application for franchise to construct a gas plant at Regina, Sask. Estimated cost $1,500,000.

Gas Plant—Worcester Gas Light Co., 240 Milk St., Worcester, Mass., awarded contract for the construction of a gas plant on Quinsigamond Ave. to Gas Machine Co., 1900 Euclid Ave., Cleveland, O. Estimated cost to exceed $40,000.

Gas Plant—Quebec Power Co., Ottawa, Ont., plans additions to gas plant at St. Malo, Que., comprising generating unit, capable of treating 80 ton of coke per day from which will be produced 2,000,000 cu.ft. of gas. Estimated cost $500,000.

Glass Plant Addition—Pittsburgh Plate Glass Co., Frick Bldg., Pittsburgh, Pa., will build a 2 story, 100 x 1,100 ft. addition to plant at Crystal City, Mo. Estimated cost $1,000,000. Private plans.

Incandescent Lamp Plant — Brinkerhoff Electric Co., c/o Lockwood, Greene & Co., Inc., 100 East 42nd St., New York, N. Y., Engrs., will soon award contract for a 3 story, 70 x 180 ft. factory at 11th St. and Schley Pl., West New York, N. J. Estimated cost $75,000.

Laboratory—C. Z. Klauder, 1429 Walnut St., Philadelphia, Pa., Archt., will receive bids until Nov. 14 for the construction of a 3 story, 50 x 159 ft. laboratory for Franklin & Marshall College, Lancaster, Pa. Estimated cost $250,000.

Laboratory—Midland Steel Products Co., E. J. Kulas, Pres., West 106th St. and Madison Ave., Cleveland, O., awarded contract for a 1 story, 80 x 120 ft. laboratory at West 106th St. and Madison Ave., to Austin Co., 16112 Euclid Ave., Cleveland, O. Estimated cost $75,000.

Laboratory — Port of New York Authority, 75 West St., New York, N. Y., will receive bids until Nov. 19, for a 4 story, 50 x 100 ft. laboratory at Fox Pl. and West Side Ave., Jersey City, N. J. Estimated cost $250,000. W. H. Burr, 120 Broadway, New York, N. Y., is consulting engineer.

Laboratory—Timken Sheet & Tube Co., Canton, O., will soon award contract for a 2 story, 42 x 100 ft. laboratory, etc., on Harrison Ave. S. W. Estimated cost $40,000.

Laboratory, etc.—Stockham Pipe & Fitting Co., H. Stockham, Pres. and Gen. Mgr., 4600 10th Ave. N., Birmingham, Ala., awarded contract for the construction of a 1 story, 60 x 95 ft. laboratory and 2 story warehouse and shipping building to H. K. Ferguson Co., Hanna Bldg., Cleveland, O.

Laboratory (Chemistry)—University of Tennessee, Knoxville, Tenn., awarded contract for the construction of a 3 story chemistry laboratory to A. R. McMurray Construction Co., Giffin St. and Island Home, Knoxville, Tenn. Estimated cost $125,000.

Laboratory (Pathological)—University of Toronto, Queens Park, Toronto, Ont., will build a 6 story, 120 x 192 ft. pathological laboratory on College St. Estimated cost $500,000. Darling & Pearson, 2 Leader Lane, Toronto, Ont., are architects. Work will be done by day labor.

Laboratory (Science) — School Board, Walkerville, Ont., awarded contract for the construction of a school, including laboratory, etc. to N. R. Ibbetson Construction Co., 9 Wyandotte St., Walkerville. Estimated cost $250,000.

Laboratory Equipment—Peter J. Dooling, Comr. of Purchase, Municipal Bldg., New York, will receive bids until Nov. 22 for laboratory equipment, for Departments of Public Welfare and Health.

Laboratories—State Bd. of Education, State House, Trenton, N. J., is having plans prepared for the construction of a 2 story, 80 x 170 ft. demonstration school including laboratories, etc. at Montclair, N. J. Estimated cost $240,000. Guilbert & Betelle, 20 Branford Pl., Newark, N. J., are architects.

Leatherboard Plant Addition — Groton Leatherboard Co., Groton, Mass., awarded contract for the construction of a 2 story, 60 x 200 ft. additional unit to leatherboard plant, to Fiske-Carter Construction Co., 11 Foster St., Worcester, Mass. Estimated cost $150,000.

Lime, Sulphate and Liquid Chlorine—Sewerage & Water Board, New Orleans, La., will receive bids until Nov. 30 for 6,500 ton of lime during 1929 for water purification work, also 1,200 ton of iron sulphate and 50,000 lbs. of liquid chlorine. Estimated cost $65,000.

Liquid Carbonic Plant—Maspeth Liquid Carbonic Corp., Maspeth Ave., Maspeth, L. I., N. Y., plans the construction of a 1 story, 66 x 130 ft. addition to plant at Maspeth Ave. and Rust St. Estimated cost $40,000. Private plans.

Lubricator Plant — Putnam Lubricator Co., Canton, O., awarded contract for the construction of a 1 story, 41 x 198 ft. plant at Second St. and McKinley Ave. N.W. to Lloyd Ream, 2401 6th St. N.W., Canton, O. Estimated cost $40,000.

Metal Reducing Plant—Improved Cinder Co., M. M. Upton, Pres., 90 West St., New York, N. Y., will soon award contract for the construction of a metal reducing plant including equipment at Van Dam St. and Newton Creek, Brooklyn, N. Y. Estimated cost $50,000. Klemert & Klie, 250 Park Ave., New York, N. Y., are architects.

Milk Condensery—City Dairy Co. Ltd. Spadina Crescent, Toronto, Ont., awarded general contract for the construction of a 2 story milk condensery to James A. Vance, Woodstock, Ont. Estimated cost $125,000.

Paint Factory—Lockwood, Greene & Co., Inc., Spartanburg, S. C., Engrs., are receiving bids for the construction of a paint factory for Stewart Bros. Paint Co., Inc., 204 South Seneca Ave., Alliance, O. Estimated cost $40,000. F. B. Jacoway, Atlanta, Ga., is resident sales manager.

Paint and Varnish Factory—Siedlitz Paint & Varnish Co., 19th and Garfield Sts., Kansas City, Mo., plans the construction of a paint and varnish plant at 18th and Euclid Sts. Estimated cost $150,000. Private plans.

Paperboard Mill Addition — Chesapeake Paperboard Co., Key Highway and B. & C. R.R., Baltimore, Md., awarded contract for a 2 story, 80 x 180 ft. addition to paperboard mill to Fred Wright Co., 217 North Calvert St., Baltimore, Md.

Pharmaceutical Supply Factory — Hoffman La Roche Co., 19 Cliff St., New York, N. Y., plans the construction of a 2 story factory at Kingland Rd., Nutley, N. J. Estimated cost $40,000. Architect not announced.

Phosporic Acid Plant—General Chemical Co., Marcus Hook, Pa., awarded contract for the construction of a 1 story phosphoric acid plant, filter house and oil storage building to H. K. Ferguson Co., Hanna Bldg., Cleveland, O. Estimated cost $100,000.

Pilot Mills—Colorado Fuel & Iron Co., W. A. Maxwell, Prod. Mgr., Pueblo, Colo., plans the construction of a plant for treating and concentrating iron ore at Pueblo, Colo., also one at Sunrise, Wyo. Estimated cost $100,000 each.

Pottery Plant — K. & M. Pottery Co., 2318 East 52nd St., Los Angeles, Calif., plans the construction of a pottery plant at South Gate, Calif. Estimated cost to exceed $40,000.

Pulp and Paper Mill—Grays Harbor Pulp & Paper Co., Hoquiam, Wash., awarded contract for the construction of first unit of paper mill to Chris Kupper's Sons, Aberdeen, Wash. Estimated cost $150,000.

Purification and Chlorination Plants—Bd. of Health, E. W. Eaton, Chn., City Hall, Newburyport, Mass., is having plans prepared for the construction of a 1 story purification and chlorination plants for purifying clams on Merrimac River. H. A. Symonds, 70 State St., Boston, Mass., is engineer.

Pyroylin Plant—Pyroylin Products Inc., 1800 West 74th Pl., Chicago, Ill. will soon award contract for the construction of a group of buildings including laboratories, mixing, storage and dissolving rooms, etc. at 4851 South St. Louis Ave. Estimated cost $40,000. A. Epstein, 2001 West Pershing Rd., Chicago, Ill., is architect.

Rayon Plant — Rayon Co. of America, Inc., D. B. Hilliard, Pres., Wilmington, Del., plans the construction of a rayon plant at Charlotte, N. C. Estimated cost $3,000,000.

Refinery—Richardson Refining Co., Big Springs, Tex., plans the construction of a refinery, 5000 bbl. daily capacity. Estimated cost $600,000. Contracts awarded for topping plant to Foster Wheeler Corp., 111 Broadway, New York, N. Y., and for Jenkins unit to Graver Corp., Todd Ave., East Chicago, Ind.

Refinery—Roxana Petroleum Co., Post Dispatch Bldg., Houston, Tex., is having plans prepared for the construction of a refinery 35,000 bbl. capacity, on channel near Harrisburg, Tex. Estimated cost $400,000. Private plans.

Refinery (Sugar)—Peoples Sugar Co., N. J. Stringham, Moroni, Utah, is having preliminary plans prepared for the construction of a sugar refinery at Lexington, Neb. Estimated cost $500,000.

Refineries — Texas Co., 17 Battery Pl., New York, and 720 San Jacinto St., Houston, Tex., plans the construction of a refinery at Amarillo, 50,000 bbl. per mo. capacity, also at El Paso and San Antonio, 90,000 bbl. per mo. capacity. Estimated cost $125,000 to $250,000 each. Private plans.

Refractories Plant — Babcock & Wilcox Co., 85 Liberty St., New York, N. Y., has acquired a 16 acre site at Augusta, Ga. and plans the construction of first unit of refractories plant. Ultimate cost $1,000,000. Work will be done by separate contracts and labor. Machinery and equipment will be required.

Rubber Factory—Cambridge Rubber Co., 748 Main St., Cambridge, Mass., plans the construction of a 5 story, 80 x 180 ft. rubber factory on Main St. Estimated cost $100,000. Architect not selected.

Rubber Factory—Fisk Rubber Co., Chicopee Falls, Mass., awarded contract for addition to rubber factory on Oak St. to F. T. Ley & Co., 20 Providence St., Boston, Mass. Estimated cost $40,000.

Rubber Factory — McClaren Rubber Co., c/o Ajax Rubber Co., 1811 E. Main St., Richmond, Va., is having plans prepared for addition to rubber factory including equipment at Charlotte, N. C. Estimated cost $40,000.

Rubber Factory—Northern Rubber Co., Ltd. T. G. Kennedy, Mgr., Guelph, Ont., awarded general contract for a 2 story, 65 x 125 ft. addition to factory on Metcalfe St. to A. Vattaglia, c/o owner. Estimated cost $55,000. Equipment will be installed.

Rubber Factory—Stedfast Rubber Co., 20 Tokio St., Mattapan, Mass., awarded contract for the construction of a 1 story rubber factory at 20-26 Tokio St. to Milton Construction Co., 141 Milk St., Boston, Mass.

Rubber Factory—Wooster Rubber Co., Wooster, O., awarded contract for the construction of a 1 story rubber factory on East Bowman St. to O. A. Lowe, Wooster, O. Estimated cost $40,000. Machinery and equipment will be installed.

Silicia Mill—Corona Silicia Co., Inc., c/o H. R. McKnight, Pres., Tulsa, Okla., is having preliminary plans prepared for the construction of a mill, auxiliary buildings, etc., at Rogers, Ark. Private plans.

Sulphuric Acid Plant—Standard Wholesale Phosphate & Acid Works, Continental Bldg., Baltimore, Md., will build an 80 x 150 ft. addition to sulphuric acid plant to increase capacity from 15,000 to 20,000 tons annually; also a 1 story, 80 x 160 ft. storage building.

Tile Factory—Stark Interior Marble & Tile Co., 122 Court Ave. S.W., Canton, O., plans the construction of a 2 story factory and warehouse at Cleveland Ave. N.W. Estimated cost $50,000.

Tire and Rubber Factory—Firestone Tire & Rubber Co., South Main St., Akron, O., c/o W. C. Harris, Jacksonville, Fla., is having plans prepared for the construction of a tire and rubber factory at Flagler St. and 12th Ave., Miami, Fla. Estimated cost $250,000.

Tire and Rubber Factory—Mansfield Tire & Rubber Co., Mansfield, O., will soon receive bids for the construction of a 2 story factory. Estimated cost $60,000.

Tire and Rubber Plant Addition—General Tire & Rubber Co., C. J. Jahant, V. Pres., 1709 East Market St., Akron, O., awarded contract for the construction of a 2 story addition to tire and rubber plant to C. W. & P. Construction Co., Second National Bldg., Akron, O. Estimated cost $200,000.

Viscoloide Plant—DuPont Viscoloide Co., F. B. Davis, Jr., Pres., Leominster, Mass., awarded contract for the construction of a factory on Lancaster St. to Wiley & Foss, Central St., Fitchburg, Mass. Private plans.

Welded Ware Factory — Wackman Welded Ware Co., 7th and Victor Sts., St. Louis, Mo., awarded contract for the construction of a 1 story, 92 x 201 ft. factory at Houston, Tex. to Forest McNeir, 2603 Chartres St., Houston, Tex. Estimated cost $50,000.